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ABSTRACT

The Eisenhower National Clearinghouse for Mathematics and Science Education (ENC) helps teachers by offering a broad assortment of services to enable them to quickly locate educational resources. This theme issue of the serial "ENC Focus" is designed to give educators information about curriculum resources available for teaching math and science in K-12 classrooms. Each issue of ENC Focus presents a selection from the Clearinghouse collection focused on a theme topic of particular interest to math and science teachers. In addition to meeting general requirements for inclusion in the ENC collection, curriculum materials listed are appropriate to the specific topic of the issue, support hands-on, active, inquiry-based methods of instruction, and are readily available. This issue offers thirteen articles (pages 16-40), and a sample of useful materials and other resources on the theme of integrating technology in the classroom and the best ways to use technology to enhance teaching and learning in mathematics and science. A description of each resource provides an abstract of the contents, subjects addressed, grade level, publication date, ordering information, price, authors, and related resources. (ASK)

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vol. 6, no. 3, 1999

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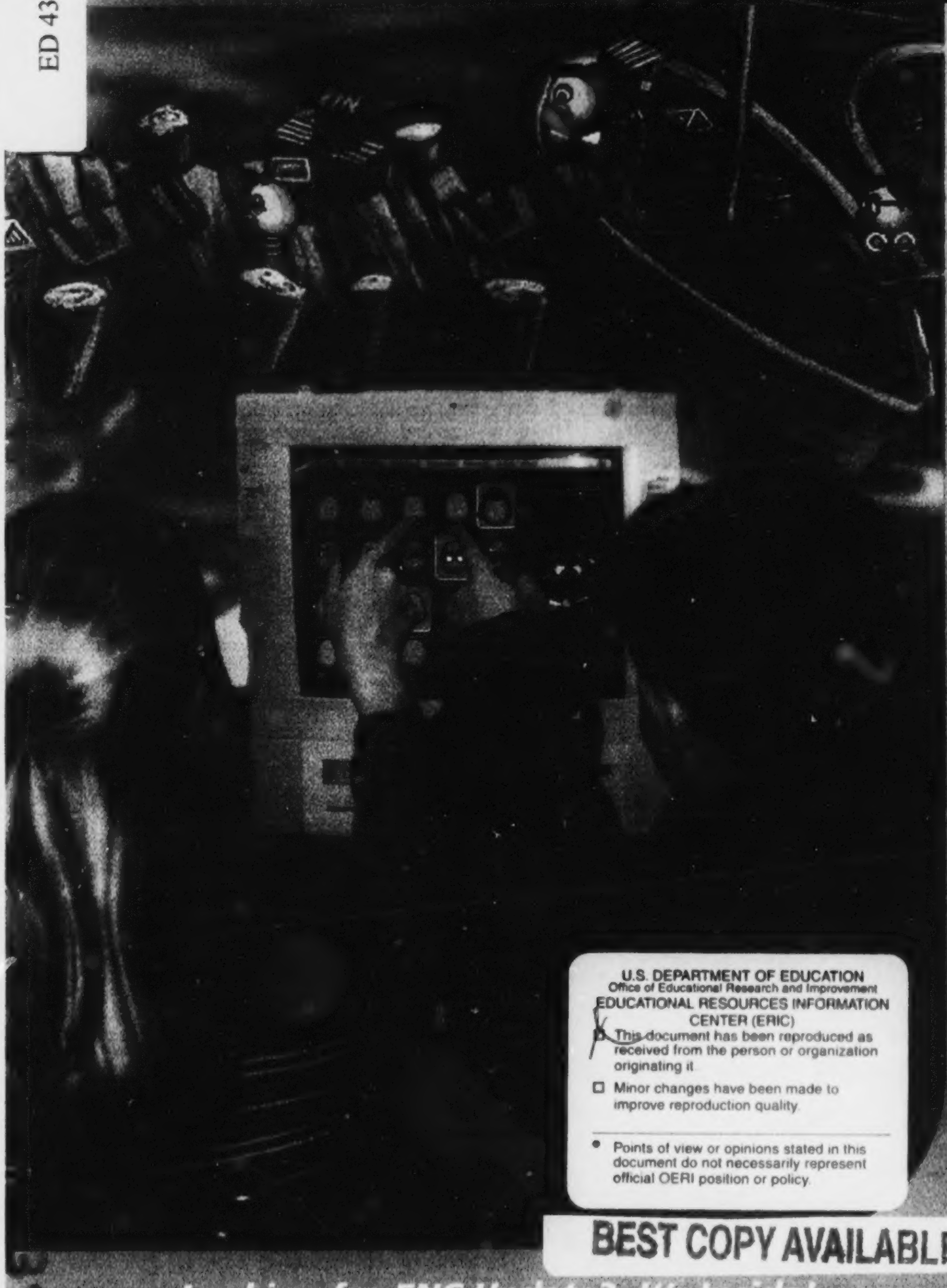
A Magazine for Classroom Innovators

INTEGRATING TECHNOLOGY IN THE CLASSROOM



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is to identify effective curriculum resources, create high-quality professional development materials, and disseminate useful information and products to improve K–12 mathematics and science teaching and learning.

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Supports teachers' professional development in math, science, and the effective use of technology.

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editorial

A MULTIMEDIA MAGAZINE

by Annette Thorson and Tracy Crow, ENC Publishing

The medium is the message.

When this phrase was first plucked from Marshall McLuhan's seminal 1964 book *Understanding Media: The Extensions of Man*, few understood what he meant by media, let alone how meaning embedded in the method by which a message is transmitted might supercede the message itself. There was perhaps even greater confusion when, in 1967, McLuhan took his ideas one step further in *The Medium is the Massage*.

Although McLuhan's writings remain controversial—and difficult to understand—his ideas have recently gained renewed interest. Clearly, he was ahead of his time in his thinking about the way electronic communication shapes meaning. One can't help but wonder what McLuhan (who died in 1980) would think of the potent combination of personal computer and Internet that we face today.

Certainly, no one can ignore the impact of that medium on the way its messages are understood. This is especially true for educators trying to integrate technology in their classrooms, and it is an underlying message in many of the articles in this issue.

It is difficult for those of us who grew up before the computer age to understand how technology is perceived by youngsters who know how to program the VCR while they are still in diapers. (*Teletubbies* coming on during naptime? No problem, Daddy! You pop in a tape, and little Courtney will show you what buttons to push.)

In a recent conversation, Lynne Schrum, president of the International Society for Technology in Education (ISTE), remarked that the school children of today are the first generation to have learned the language of technology at that magical stage when language is so easily acquired. Teachers, and all current adults, learned technology as a second language, with all the struggles that entails. (See her article and the ISTE National Educational Technology Standards starting on page 16.)

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That struggle is very much in evidence here at ENC. At the same time that we have been improving our print products, like *ENC Focus*, we have also been finding better ways to deliver our content online. Even as this magazine is published, ENC Online is undergoing a major revision to make it easier for teachers to use, more loaded with the content they need. We wrestle with what it really means to have both a print presence for *ENC Focus* and a web site that delivers much of the same content but in a very different form.

In her column "Using the Internet in the Classroom: Becoming a Critical Consumer of the Web" (page 11), Kim Roempler points out that those who publish on the Internet should be expected to make best use of the medium. Defining best use and making it happen is ENC's ongoing challenge.

As our print and online products mature, and as editorial and technical staff learn more about the Internet as a publishing medium, we are making progress. We have learned that it would be a terrible waste of the web to just plunk a print page, unchanged, on the computer screen, even if that would be most comfortable for many K-12 teachers, not to mention easier for us.

We have also come to appreciate the boundless capacity of the World Wide Web, which allows us to share everything ENC creates — including Resource Finder, the database of ENC's huge collection of educational materials — with educators all over the world. If we tried to print and mail all of this material, your copy would not fit in a postal service truck, let alone your mailbox, and the paper used would be fatal to our forests. The Internet removes these concerns, giving us enormous freedom — and a challenge to organize the vast content ENC puts online in a way that will make it accessible and useable, no matter what route teachers take to get there.

So what will you find when you come to ENC Online and click on the topic Integrating Technology in the Classroom? You will find everything that you hold in your hands, plus more. Much of the content published only online wouldn't make as much sense in a print magazine. For example, although we do include lists of web sites here in the print version, online you will find longer lists complete with active links, plus other material that is specifically about the web.

We welcome your comments as we work to define what content is best for the web site and what is best for the print magazine. With your help, we hope that each medium will serve your needs in its own unique way.

Meanwhile, when you see invitations in this print publication to come to http://www.enc.org/focus/edtech/ for more, we hope you will take advantage of this opportunity to explore a medium where the message is truly limitless. ◉

Email the writers at athorson@enc.org *or* tcrow@enc.org

References

McLuhan, M. and Fiore, Q., (1967). *The Medium is the Massage.* New York: Random House.

McLuhan, M. (1964). *Understanding Media: The Extensions of Man.* New York: McGraw-Hill.

For more information about McLuhan, visit the following web sites.

Marshall McLuhan Center on Global Communications: http://www.mcluhanmedia.com/

The McLuhan Program in Culture and Technology, University of Toronto:
http://www.mcluhan.utoronto.ca/mm.htm

Calling All Classroom Innovators:

WRITE FOR ENC!

ENC invites readers to contribute articles for upcoming issues of *ENC Focus: A Magazine for Classroom Innovators.*

Topics and Deadlines:

Math and Science in the Real World
Submissions due December 1, 1999

Educational Equity
Submissions due March 1, 2000

School-Business Partnerships
Submissions due June 1, 2000

Topics and deadlines subject to change without notice.

Submission Guidelines:

Articles should be of interest to teachers of K-12 mathematics and science. Content should be grounded in the new educational standards while being short (500 to 2000 words) and compelling.

We particularly invite teachers to write about their classroom experiences, using first person and a conversational tone. Please note that library research papers written in academic language for graduate school courses are unlikely to be selected for publication. We do, however, encourage you to include a few, carefully selected references. All content must be original, and all quotations must be properly cited.

We also publish essays by K-12 students about their successes in mathematics and science. Teachers are encouraged to assist students in writing and submitting materials for publication.

Photos or other illustrations add interest, and good illustrations increase your chances for publication. However, we can use photos of students only if we receive written parental permission for those under 18 years of age.

Those considering submission of unsolicited manuscripts are encouraged to send a proposal via email:

athorson@enc.org

Or by letter:

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Come to http://www.enc.org/focus/edtech/ to find live links to all the web sites mentioned in this publication.

ENC's Partners:

In each issue, *ENC Focus* features one of the many organizations that collaborate with ENC to promote educational improvement. In this issue, we take a look at NetTech, one of six regional consortia developing a network of resources and support for integrating technology in education.

Net*Tech*

The Northeast Regional Technology in Education Consortium

Educational Technology for Educational Leaders

by Juyong Pae, ENC Publishing

"So now that the technology is installed, what do we do? How do I help teachers meaningfully integrate technology into the curriculum? How can I tell what effect technology is having on learning?"These are all questions that many school, district, and state education leaders are asking, as increasing numbers of classrooms gain computers and Internet access.

In one part of the country, answers are being provided by NetTech, the Northeast Regional Technology in Education Consortium. NetTech is a partnership of Brown University, the City University of New York (CUNY), the Education Development Center (EDC), the Eisenhower National Clearinghouse (ENC) at The Ohio State University, the University of Maryland, and TERC, an educational research organization in Massachusetts. NetTech is one of six Regional Technology in Education Consortia (R*TECs) established by the US Department of Education in 1995.

The goal of the R*TECs is to assist schools and other educational organizations, including adult literacy centers, successfully use technology for learning and teaching. The R*TECs develop avenues for idea exchanges and resource sharing. They also conduct regional activities that provide professional development and technical assistance, as well as act as channels for dissemination of research and resource information.

NetTech's region includes the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, and the District of Columbia.

Highlights of Current NetTech Projects

Following are brief descriptions of just a few of the many initiatives NetTech sponsors or organizes to foster effective use of technology in education.

Technology in Teacher Education Networks (T-TENs)
The purpose of these networks is to increase technology use in teacher education programs and to improve the training of preservice teachers in information technology. T-TENs bring together TechMentors, who are college or university faculty already using technology in preservice education, and TechMentees, teacher educators who wish to learn how to integrate technology into their instruction.

Each T-TEN begins with a one-day conference, where TechMentors demonstrate materials and strategies and help TechMentees develop technology plans. Following the conference, participants work together as an online community, where they build a web site (using a T-TENs template) to serve as a forum for idea exchange, to provide examples of effective practices, and to support collaborations among students, faculty, and practicing teachers. Through this online network, participants share resources, discuss their efforts, maintain a journal, and stay abreast of strategies. Participants also build the site so that it can serve as an online course to help additional faculty interested in integrating technology.

There will be a total of six T-TENs, each serving a state or cluster of states. So far, three T-TEN "kick-off" conferences have taken place, one at Kent State University (serving Ohio), one at the University of New Hampshire (serving New England), and one at the University of Maryland (serving the District of Columbia/Maryland/Delaware cluster). Web site development for each of those is underway. T-TEN conferences for Pennsylvania, for New Jersey, and for New York are currently being planned. Also, an overarching T-TENs web site for the NetTech region is currently under construction and should be completed by year's end. For more information about this program, visit http://www.wam.umd.edu/~sjkohn/T-Tens2.html.

LEADERSHIP AND THE [illegible] TECHNOLOGIES

Leadership and the New Technologies (LNT)
LNT is a series of online seminars for educators at the district level. Each workshop runs for eight to 10 weeks and involves discussions, readings, and small projects.

Planning a District-Wide Technology Infrastructure was a seminar that ran during the 1998/1999 school year. This workshop introduced district leaders to the basic concepts of computer networks and infrastructure to help them become better-informed decision makers regarding district-wide technology implementation. Another seminar, Keeping Kids Safe: Policy Implications of the Internet in Schools, examined issues regarding acceptable use policies, student safety, and filtering of content. This seminar drew on a NetTech-supported case study, "Trouble Right Here in River City." To read this case study, go to:
http://edc.techleaders.org/wkaup98/readings/aupcase.htm

LNT is currently hosting a series of online seminars, Emerging Technologies for Active Learning, which explores how technologies such as remote-sensing and 3-D virtual worlds might be used in classroom practice or for professional development. Two workshops in the series have already occurred. Archives of these workshops, along with other past workshops, are available from the LNT web site. Click on Online Workshops at:
http://www.edc.org/LNT/

Technology Making a Difference (TMD) Institute
This series of professional development experiences is geared to instructional technology specialists and library-media specialists. TMD institutes allow participants to grapple with a specific problem from each of their schools as they explore technology integration from a systemic viewpoint.

In addition to the TMD web site http://tmd.terc.edu, there is an Instructional Technology Specialist (ITS) web site that complements the TMD Institutes. It will be available through NetTech's web site, beginning in November, 1999. This site is for instructional technology specialists by instructional technology specialists. The site has content in four major areas: Technical Issues, Professional Development Issues, Curriculum Integration Issues, and Technology in Context. For an idea of specific topics covered by the four major areas, visit http://www.nettech.org/projects/techcoord/ra[illegible]ng.htm.

Technology in Adult Basic Education
Recently, under the sponsorship of NetTech, the Literacy Assistance Center (LAC) in New York City conducted a three-month institute on instructional technology for a group of adult literacy providers. LAC's Teachers, Technology, and Leadership Institute helped participants improve their technology skills and expand their knowledge of Internet resources. Many of the participants returned to their respective programs prepared to take leadership roles in integrating technology. They are now providing professional development for teachers in their respective adult literacy programs, and others are working on such issues as making computers more accessible to adult learners.

During the institute, participants met in person and online for an extended period of time. They attended presentations by experts in educational technology from such organizations as TERC and the Community Technology Center's Network. To gain a hands-on, contextual experience, they also conducted their own inquiry-based, small-group projects using the web-based tools they had just discovered. Finally, they learned HTML and built Internet presentations of their inquiry group projects. Visit the participant discussion boards and their group web pages at:
http://www.lacnyc.org/pubs/update/Summer99/tech21.htm

Case Studies of Technology Integration in K-12 Classrooms
This NetTech initiative was developed to investigate how technology can successfully be integrated into the K-12 classroom and to help teachers reflect on their own teaching practices regarding the use of technology. With support from NetTech, an inquiry group of eight teachers from the technology-rich Hyattsville Elementary School in Hyattsville, Maryland, conducted research and wrote the following case studies: How Can Technology Enhance Children's Natural Curiosity, Using Technology to Explore the Rainforest Biome, and Using the SmartBoard to Arouse Student Interest and Participation in a Classroom Environment. The case studies were presented at a Research Festival at the University of Maryland and at the Fairfax County (Virginia) Teacher Researcher Conference. They can be viewed at:
http://www.mindspring.com/~sk89/Hyattsville-ES-Science.htm

For information on additional NetTech activities and products, visit the web site at http://www.nettech.org/. NetTech also produces a free electronic newsletter providing current news in education technology and informing readers of NetTech-sponsored institutes and initiatives. Subscribe at:
http://sagan.enc.org/4news/cgisubscribe.subscribe.html
or send email to debs@enc.org ◉

Juyong Pae is a news writer and editor for NetTech ***and ENC.***
Email her at jpae@enc.org

Come to http://www.enc.org/focus/edtech/ for links to all the web sites mentioned in this article.

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ENC Partners: *Eisenhower* Consortia *&ENC* Demo Sites

Appalachian Region

Kentucky, Tennessee, Virginia, West Virginia

consortium

Eisenhower Regional
Math/Science Consortium at AEL
Pam Buckley, Director
1700 North Moore Street, Suite 1275
Arlington, VA 22209
Toll-free: (800) 624-9120
Fax: (703) 276-0266
Email: buckleyp@ael.org
aelinfo@ael.org
URL: http://www.ael.org/eisen/

demo site

George Watson
Marshall University
Room 101 Jenkins Hall
Huntington, WV 25755
Phone: (304) 696-2874
Fax: (304) 696-6221
Email: watson@marshall.edu

Mid-continent Region

Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota, Wyoming

consortium

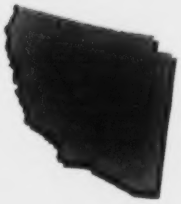
Eisenhower High Plains Consortium
for Mathematics and Science
John Sutton, Director
Mid-continent Regional Educational Laboratory
2550 South Parker Road, Suite 500
Aurora, CO 80014
Toll-free: (800) 949-6387
Fax: (303) 337-3005
Email: jsutton@mcrel.org
URL: http://www.mcrel.org/hpc/

demo site

Eisenhower High Plains Consortium
for Mathematics and Science
2550 South Parker Road, Suite 500
Aurora, CO 80014
Phone: (303) 337-0990
Fax: (303) 337-3005
Toll-free: (800) 949-6387

Far West Region

Arizona, California, Nevada, Utah



consortium

WestEd Eisenhower Regional Consortium
for Science and Mathematics Education
Art Sussman, Co-Director
Steve Schneider, Co-Director
730 Harrison Street
San Francisco, CA 94107-1242
Phone: (415) 241-2730
Fax: (415) 241-2746
Email: asussma@wested.org
program: werc@wested.org
URL: http://www.wested.org/werc/

demo site

Anne Malley
Biodiversity Resource Center
California Academy of Sciences
Golden Gate Park
San Francisco, CA 94118
Phone: (415) 750-7361
Fax: (415) 750-7106
Email: amalley@cas.calacademy.org

North Central Region

Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, Wisconsin

consortium

Midwest Consortium for Mathematics and Science Education
Gil Valdez, Director
North Central Regional Educational Laboratory
1900 Spring Road, Suite 300
Oak Brook, IL 60521-1480
Phone: (630) 571-4700
Fax: (630) 571-4716
Email: valdez@ncrel.org
URL: http://www.ncrel.org/msc/msc.htm

demo site

Susan Dahl
Fermi National Accelerator Laboratory
Lederman Science Education Center
PO Box 500, MS 777
Batavia, IL 60510-0500
Phone: (630) 840-3094
Fax: (630) 840-2500
Email: sdahl@fnal.gov

Mid-Atlantic Region

Delaware, District of Columbia, Maryland, New Jersey, Pennsylvania

consortium

Mid-Atlantic Eisenhower Consortium for
Mathematics and Science Education
Keith M. Kershner, Director
Research for Better Schools
444 North Third Street
Philadelphia, PA 19123-4107
Phone: (215) 574-9300 ext. 279
Fax: (215) 574-0133
Email: kershner@rbs.org
mathsci@rbs.org
URL: http://www.rbs.org/

demo site

Karen Elinich
The Franklin Institute Science Museum
222 North 20th Street
Philadelphia, PA 19103
Phone: (215) 448-1338
Fax: (215) 448-1274
Email: kelinich@fi.edu
URL: http://www.fi.edu/

Northeast and Islands Region

Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, Puerto Rico, Virgin Islands

consortium

Eisenhower Regional Alliance
for Mathematics and Science
Education Reform
Mark Kaufman, Director
TERC
2067 Massachusetts Avenue
Cambridge, MA 02140
Phone: (617) 547-0430
Fax: (617) 349-3535
Email: mark_kaufman@terc.edu
URL: http://ra.terc.edu/alliance/hubhome.html

demo site

Molly Singsen
Regional Alliance/TERC
2067 Massachusetts Avenue
Cambridge, MA 02140
Phone: (617) 873-9725
Fax: (617) 349-3535
Email: molly_singsen@terc.edu

Contact the Eisenhower Consortium or ENC Demonstration Site that serves your state for assistance in improving mathematics and science education.

Northwest Region

Alaska, Idaho, Montana, Oregon, Washington

consortium

Science and Mathematics Consortium for Northwest Schools
Ralph T. Nelsen, Director
Columbia Education Center
171 NE 102nd Street
Portland, OR 97220-4169
Phone: (503) 760-2346
Fax: (503) 760-5592
Email: ralph@col-ed.org
URL: http://www.col-ed.org/smcnws/

demo site

Kristen McCowan
Information Science Hall
Oregon Museum of Science and Industry
1945 SE Water Avenue
Portland, OR 97214-3354
Phone: (503) 797-4585
Fax: (503) 797-4568
Email: kam@omsi.edu

Southeast Region

Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina

consortium

Eisenhower Consortium for Mathematics and Science Education at SERVE
Francena Cummings, Director
1203 Governors Square Boulevard, Suite 400
Tallahassee, FL 32301
Phone: (850) 671-6033
Fax: (850) 671-6010
Email: fdc3530@garnet.acns.fsu.edu
URL: http://www.serve.org/Eisenhower/

demo site

Ed Anderson, Regional Coordinator
Metro Atlanta Georgia Youth Science & Technology Center (GYTSC)
PO Box 54244
Atlanta, GA 30308
Phone: (404) 589-8008
Fax: (404) 589-0032
Email: edanderson@mindspring.com

Pacific Region

American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Hawaii, Republic of the Marshall Islands, Republic of Palau

consortium

Pacific Mathematics and Science Regional Consortium
Paul Dumas, Director
Pacific Resources for Education and Learning
1099 Alakea Street, Suite 2500
Honolulu, HI 96813
Phone: (808) 441-1300
Fax: (808) 441-1385
Email: dumasp@prel.hawaii.edu
askmathsci@prel.hawaii.edu
URL: http://w3.prel.hawaii.edu/programs/ms/math-science.html

demo site

Alice Borja
Pacific Mathematics and Science Regional Consortium
PREL Guam Service Center
PO Box 326359
Hagatna, GU 96932-6359
Phone: (808) 533-6000 ext. 133
Fax: (808) 533-7599
Email: borjaa@prel.hawaii.edu

Southwest Region

Arkansas, Louisiana, New Mexico, Oklahoma, Texas

consortium

Eisenhower Southwest Consortium for the Improvement of Mathematics and Science Teaching
Steve Marble, Director
Southwest Educational Development Laboratory
211 East Seventh Street
Austin, TX 78701
Phone: (512) 476-6861
Fax: (512) 476-2286
Email: scimast@sedl.org
URL: http://www.sedl.org/pitl/scimast/welcome.html

demo site

Southwest Consortium for the Improvement of Mathematics and Science Teaching (SCIMAST/SEDL)
211 East Seventh Street
Austin, TX 78701-3281
Phone: (512) 476-6861
Fax: (512) 476-2286

Eisenhower National Clearinghouse for Mathematics and Science Education

Columbus, Ohio

demo site

Gail Hoskins
Eisenhower National Clearinghouse
The Ohio State University
1929 Kenny Road
Columbus, OH 43210-1079
Toll-Free: (800) 621-5785
Phone: (614) 292-7708
Fax: (614) 292-2066
Email: ghoskins@enc.org
URL: http://www.enc.org/

enc
Eisenhower National Clearinghouse for Mathematics and Science Education

ENC Capital Collection & Demonstration Site

Washington, D.C.

demo site

Shirley DeLaney
The George Washington University
Instructional Media & Materials Center
Gelman Library, Room B06
2130 H Street, NW
Washington, DC 20052
Phone: (202) 994-7048
Fax: (202) 994-4520
Email: enc@gwis2.circ.gwu.edu

CAPITAL COLLECTION • ENC

ENC in Action:

One District's Math and Science Solution

This library media specialist finds a variety of ways to use ENC's products and services to help teachers all over her school district.

by Nancy Voltmer, Saydel Community Schools, Des Moines, Iowa

The first day I participated in Adventures in Supercomputing (AiS), a program started by the Department of Energy to encourage girls and minority students to take more math and science, I was seated between a math teacher and a science teacher. During our training, we learned about resources that were available to help achieve this goal, and the Eisenhower National Clearinghouse was mentioned. The other teachers seemed to know what this was, and I quickly learned that ENC offered wonderful resources for teachers and media specialists. The first thing I ordered was a free copy of *The Guidebook of Federal Resources for K-12 Mathematics and Science* to place in our professional collection. The staff were able to look up contacts for federal programs in math and science.

Before we had Internet access, we used ENC's CD-ROMs to look for additional materials teachers could use. For example, when math teacher Holly Lester was updating her curriculum and looking for information, we used the CDs to look at materials for students. Now that we have Internet access, we go to the web site http://www.enc.org/ and do a Resource Finder search where we can enter key word(s), grade level, and cost. Recently, when I looked up information about bats for third graders, I found 72 documents, which included books, web sites, and other media. The database also includes kits, videos, and teacher guides with the copyright date and ISBN number.

This spring, second-grade teacher Trista Peitzman and Michael Bechtel, a high school science teacher, planned a lesson together following a study of animals and ecology/conservation. While half of the second grade class went to see the animals in Mike's room, I took the other group to our distance learning classroom. I had already checked the ENC web site to search for animal resources appropriate for second graders; one was the San Diego Zoo web site. I pulled this up on the computer and displayed it on the television monitors while we discussed the various animals.

During the summer, when the Science Curriculum Committee looks at materials, they will be pointed to ENC to check grade levels and resources. They will also be given a copy of the *ENC Focus* on Family Involvement in Education and information on how to request other products.

I have learned a great deal about math and science since the first day of AiS training. Speaking as one who is somewhat mathematically and scientifically challenged, I have found that the Eisenhower National Clearinghouse is an invaluable tool for teachers and media specialists. When presenting at staff development workshops or conferences, I always include ENC in the math and science bookmarks I provide. I know that teachers can often experience information overload and may not feel ready to try learning a new tool, but I also know that eventually they will check it out and find, as I have, that ENC is very useful. ●

Nancy Voltmer is a library media specialist for Saydel Community Schools in Des Moines, Iowa. She can be reached at the high school (515) 262-9325 or via email: voltmer@netins.net

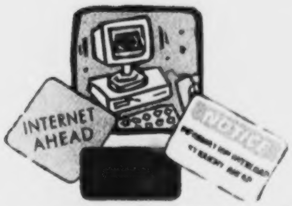
Editor's Note:
For more information about the national Adventures in Supercomputing Program, check out their web site at http://www.krellinst.org/AiS/

Do you have a story about how you used ENC products or services? Please email it to us at editor@enc.org *or mail to Focus Editor, ENC, The Ohio State University, 1929 Kenny Road, Columbus, OH 43210-1079.*

Visit http://www.enc.org/order/ for a complete list of ENC's FREE publications

USING THE INTERNET IN THE CLASSROOM

Becoming a Critical Consumer of the Web



In each issue, ENC's Associate Director of Instructional Resources writes about her experiences using the Internet as an educator.

by Kimberly S. Roempler, ENC Instructional Resources

Since I began working at ENC in 1995, I have looked at thousands of web sites. A big part of my job as Science Content Specialist was finding sites of interest to teachers for inclusion in ENC's Collection and selecting sites to be featured in Digital Dozen. (See box below about ENC Online for more information.)

At the beginning, my selection criteria were few — mostly I was in awe of any site that had color or something that moved around on the screen. This has changed. From years of evaluating web sites for ENC, from my interactions with my students and my daughter, and by talking to teachers about what sites were useful to them in their work, I have come to some conclusions about what to expect from the web. My expectations have grown right along with the growth of the Internet.

Even with a great deal of experience, finding high-quality web sites is not easy. The number of resources available via the Internet is immense and thousands of new sites go online every month.

To further complicate matters, there are few, if any, quality controls for the information that is made available. Web sites that contain accurate and reliable information coexist with sites that contain information that is incomplete or biased — or in some cases purposefully false. The differences between reliable and unreliable sites may be imperceptible, especially for someone who is not an expert in a specific topic area.

It is clear that all educators must become informed Internet consumers. According to Kathy Schrock (see More Roempler's Recommended Resources at the bottom of page 13), teachers can learn to evaluate web sites by considering three criteria:

- navigation and usability,
- authorship, and
- most important, content validity.

When selecting web sites for the ENC collection, I have identified two more extremely important criteria:

- audience engagement, and
- using the strengths of web technology.

Navigation and Usability

I am very lucky at ENC to have a computer with all the bells and whistles and a technical support staff to help me when something breaks or when I can't get an application to load (which happens all too often). Most educators are not that fortunate. For them and their students, a web site must be easy to navigate and use.

The first step in navigation is accessing the site in the first place. Access is determined by a match between the way you connect to the Internet and the kind of connection the resource requires. The most useful sites are "viewable" by all web browsers (e.g., Netscape Navigator and Microsoft Internet Explorer).

It can be very frustrating when a site takes a long time to appear on your screen. No one wants to wait for web pages to load large graphic files. I appreciate sites that provide text-only options and thumbnail versions of large graphics so the site can display very quickly.

Many multimedia objects on the World Wide Web require a helper application or plug-in. Some helper applications, such as Shockwave, require an excessive amount of memory and time to load and run multimedia animation. If you think a multimedia file is slow, so will your students. You'll want to weigh carefully the benefits of an animated site before using it in class.

It is important that a site be accessible when you need it. Some sites offer only a limited number of connections or are so popular that they may not be accessible at the right time for you and your students. Many NASA sites become very busy and difficult to access when new scientific discoveries are made.

ENC Online Provides Links to Quality Web Sites

One of the best places to look for quality math and science web sites is ENC's Digital Dozen http://www.enc.org/classroom/dd/nf_index.htm. Each month, ENC's science and math content experts choose 13 exemplary web sites. All past sites (from August 1995) are archived, and the archive is searchable. Each of these sites is also cataloged and becomes part of Resource Finder, ENC's online database of information on more than 14,000 science, math, and professional development resources.

Resource Finder http://www.enc.org/rf/nf_index.htm#rf is another place to search for sites that have been culled from the web by ENC's content experts. These sites have been selected based on their usefulness to educators and cover grade levels preK to 12. ENC's search engine allows users to specifically limit searches to World Wide Web sites, as well as grade level and content. Go to the Enhanced Search http://watt.enc.org/main2.html, click on the RESOURCES button, scroll down and select World Wide Web (WWW) resource. (The number at the end of that phrase indicates the number of WWW sites that have been cataloged to date.) Now click on the GRADE LEVEL button, and choose the grades levels that are of interest to you. Now click on the SUBJECTS button, and choose the topic. (Changes are in store for ENC Online, so some of these strategies will soon be out of date. The web site will provide guidance about the best way to use our new resources.)

Once a site is accessed, navigation issues emerge. A good site will have a cleanly designed homepage with a well-labeled table of contents or site map. Sometimes home pages are so cluttered I don't know where to start.

Navigation links within the site need to be easy to find and clearly labeled. Are you able to easily follow a path to get to the information you seek? High-quality sites include search engines to assist you in finding the location of specific material. Nonfunctioning links to other web sites is a sign that a site is not properly maintained.

Another factor that affects usability is the inclusion of advertisements. Recently, I have noticed an increase in advertising, even on educational sites. One had some wonderful lesson plans, but it wasn't chosen for the ENC Collection because a user had to go through four levels of advertising to get to them. Banner advertisements may distract students from the science content and slow down the browser. Links within the ads can also lead you so far away from the original site that you may never get back.

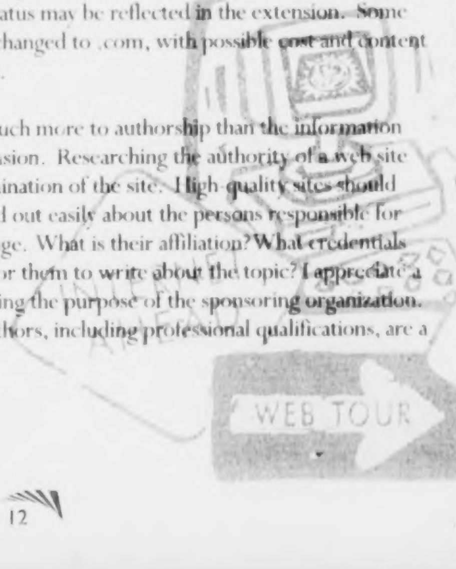
Authorship

Thinking about advertising on the Internet leads us to the crucial question of authorship. The first clue comes in the URL (web address) extension, the part that comes after the "dot." Does the URL contain .com, .gov, .edu, or .org?

A friend of mine learned the meaning of extensions when she typed .com instead of .gov to access a popular federal web page. (Luckily, she did it at home as part of her lesson planning and not in front of her students.) She learned the hard way that sites from federal government sites end in .gov while commercial businesses usually include .com.

School sites often include k12 in the address, and college and university sites often include .edu. Sites from nonprofit organizations, such as ENC, often include .org. A tilde (~) in the address usually indicates that the page is maintained or created by an individual, rather than representing an organization, a business, or a school. A change in an organization's status may be reflected in the extension. Some good .edu sites have changed to .com, with possible cost and content implications for users.

Of course, there is much more to authorship than the information found in a URL extension. Researching the authority of a web site requires careful examination of the site. High-quality sites should enable the user to find out easily about the persons responsible for the contents of the page. What is their affiliation? What credentials make it appropriate for them to write about the topic? I appreciate a link to a page describing the purpose of the sponsoring organization. Biographies of the authors, including professional qualifications, are a plus.



Sites should also provide a way for users to get in touch with the authors, not only to ask questions but also to verify the legitimacy of the page's sponsor. An email address for the web administrator is good, but a site should also list a phone number and postal address.

Content Validity

The most important factor to consider when evaluating a web site is the content. Some people, especially young students, believe that if information is in writing, whether in a book or on the web, that means that it is accurate. Because web publishing is so fast and affordable, there is even less control on web content than is typical in print publications.

Accuracy of scientific and mathematical content is crucial. In addition to looking out for misinformation, teachers also need to evaluate whether the content is comprehensive or cursory. Just because a site has exciting graphics does not mean it has rich content.

Another important concern is whether the content is biased. Is the site equitable in regard to culture, gender, and race? Does it promote one point of view? Some web sites are known to advocate different causes, and we need to help students keep these biases in mind when they evaluate the information, just as we do with print and television sources. In science class, students may find sites sponsored by grassroots environmental organizations. The information in these online publications may be slanted. We need to help students cope with that and with the realization that every organization or company presents its particular view.

Although the web seems new, it still could contain out-of-date information. Dates as to when the page was written, when the page was first placed on the web, and when the page was last revised are some indicators of timeliness. The information should be current and accurate, and it should be updated regularly.

Web sites should be judged by the same standards we use with other publications. Information should be supported with bibliographies that identify sources used, both to give credit to the authors and to provide readers with avenues for further research. Indications that the content has been through a peer review process add to the credibility. Charts and/or graphs containing statistical data should be clearly labeled and easy to read. The source of data should be referenced. Finally, the information should be free of grammatical, spelling, and other typographical errors.

Audience Engagement

Students cannot become engaged with material they do not understand. One of the most pervasive problems I come across in educational web sites is the misalignment of reading level with the intended audience. I find sites supposedly designed for the early elementary grades that contain nothing but text readable by a much older audience. Sometimes the content covered is developmentally inappropriate for the grade level of the intended audience. A related issue is whether the content of an educational site is appropriate and relevant to the curriculum.

Considering the reading level of students does not necessarily guarantee that they will be engaged with the content of a web site. First, it must get and maintain students' attention. Then, and even more important, the site must get students actively involved in the learning process; this is critical if they are truly going to understand science and math concepts. A good site should enrich the user's experience and expand his or her imagination.

When thinking about audience engagement, I ask some tough questions about a web site. Does the content promote inquiry learning? Are students encouraged to think and reflect? Are critical thinking skills needed to analyze and synthesize information?

True engagement cannot occur unless students are encouraged to transfer the mathematical or scientific knowledge that they learn on the web site into an activity done in the classroom or at home. At the very least, students should be encouraged to continue exploration and research with additional hypertext links on the web site.

One of the most engaging features a web site can offer is the opportunity for students to communicate with scientists or other field researchers through the site. Some sites offer other types of interactive opportunities for students, such as data sharing with other students.

Using the Strengths of Web Technology

The web is an educational tool—one of many available to educators. Teachers determine the best tool to use in every teaching situation, be it textbook, CD-ROM, videotape, or the web. Not every tool fits every job.

Many sites look just like textbooks, and I have to ask why not just use a textbook? However, when features are added such as interactive animation, videos, graphical organizers, concept maps, or links to related resources, the online material provides much more than a typical textbook.

Still, it is important to look at elements of the Internet media with a critical attitude. Are sound, video, and graphics well done and meaningful? Does the use of multimedia promote learning or is it just a flashy novelty?

I am always on the lookout for content that is unique and not available elsewhere. Particularly worthwhile are web sites that provide continually updated data from across the globe, for example, ocean temperature data relayed from a buoy in the middle of the Pacific Ocean.

In the Final Analysis

Every web site does not need to meet every one of the criteria discussed in this article to be useful, but the more of them a site does meet, the more likely it is to be a worthwhile place for you and your students to spend time. I am encouraged at the wonderful science, math, and professional development sites that are being produced all over the country. An important part of ENC's mission is to help you find them. ◉

Kimberly S. Roempler is Associate Director of Instructional Resources at ENC. Contact her via email: roempler@enc.org

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ROEMPLER'S RECOMMENDED RESOURCES:

Here is a sampling of sites that exemplify the criteria discussed in this article.

Navigation and Usability

ENC's Teacher Change: Improving K-12 Mathematics
http://change.enc.org/

Nine Planets
http://www.seds.org/nineplanets/nineplanets/

Sustainable Seas Expedition
http://sustainableseas.noaa.gov/index.html

Authorship

Cool Science for Curious Kids
http://www.hhmi.org/coolscience/index.html

Beyond Discovery: The Path from Research to Human Benefit
http://www4.nationalacademies.org/beyond/beyonddiscovery.nsf/web/homepage?OpenDocument

Content Validity

Genesis Mission
http://genesismission.jpl.nasa.gov/

Smithsonian Lesson Plans in Science
http://educate.si.edu/resources/lessons/scilist2.html#start

Audience Engagement

The Science of Hockey
http://www.exploratorium.edu/hockey/

Little Shop of Physics
http://129.82.166.181/

Using the Strengths of the Web

Explore Science
http://www.explorescience.com/

Manipula Math with JAVA
http://www.ies.co.jp/math/java/index.html

Virtual Cell
http://personal.tmlp.com/Jimr57/

MORE ROEMPLER'S RECOMMENDED RESOURCES!
The list includes Kathy Schrock's Guide for Educators, which provides Critical Evaluation Surveys for elementary, middle, and secondary school levels as well as a short survey for Virtual Field Trip sites. Visit http://discoveryschool.com/schrockguide

Visit the online version of this magazine for an extensive list of other web sites that provide guidance on Internet evaluation.
http://www.enc.org/focus/edtech/

For earlier "Using the Internet in the Classroom" columns, visit the Departments section of http://www.enc.org/focus/

Innovators Forum Online

While no one has answers for all the issues facing educators today, progress is possible when classroom innovators, like yourself, exchange ideas.

To make such an exchange possible, the online version of *ENC Focus: A Magazine for Classroom Innovators* http://www.enc.org/focus/ features an electronic Innovators' Forum. Readers are invited to send concerns and comments via email to editor@enc.org. Selected messages will be published online, and of those, a few will appear here, so that readers of the print version of the magazine can participate.

To get the Forum rolling, here is one email message sent in response to a recent request that administrators share their school's most pressing problems. We invite you to respond or to send a message on another topic of concern to you.

Dear Innovators,

As a K-12 Supervisor of Instruction, I have found that the most pressing problem in math and science is the application of facts. Math computation is very good, but students lack the ability to think through a problem and apply several steps to solve it.

Reading comprehension is being addressed this year in hopes the students will be able to better understand the problem they are being asked to solve. This is also a problem in science. Students cannot comprehend the steps necessary to solve a problem or set up an experiment. We have ignored the reading skills needed to understand math and science for too long. This is an essential skill for any math and science function.

Our district is fortunate to have a full-time teacher partner in math and science helping teachers with curriculum mapping and alignment with the national standards and our state framework. Any additional information in this area would be very helpful.

Nancy Williamson, Supervisor of Instruction
Oneida School District
Oneida, Tennessee

Please keep in mind that Innovators' Forum offers a way for you to discuss issues with other classroom innovators. You can get information and answers to many educational questions from ENC's Information Services Department. Contact them by email library@enc.org or telephone (614) 292-9734.

When you contribute to Innovators' Forum, please include your full name, your title or the grade you teach, the name of your school or district, and your city and state. Please note that comments selected for publication may be edited for brevity and clarity and that by submitting them you are giving permission for your comments to appear in both the print and the online versions of this publication.

Again, the *ENC Focus* email address is editor@enc.org. Or send your comments by mail: *Focus* Editor, ENC, The Ohio State University, 1929 Kenny Road, Columbus, OH 43210-1079. If you send a letter, please include your telephone number so we can contact you if necessary.

Going for Grants

FOUNDATIONS

Past Going for Grants columns covered federal and corporate foundation sources of funds for educators. See them at http://www.enc.org/focus/

By Tracy Crow, ENC Publishing

You would be amazed at the number of foundations in the United States that have money to grant to nonprofit groups and individuals involved in educational improvement. The term foundation covers many different types of charitable institutions including corporate, private, public, independent, family, and operating.

Corporate foundations, discussed in the previous issue of *ENC Focus* (volume 6, number 2), are relatively easy to understand—they are established either in collaboration with or parallel to an existing for-profit company to support particular activities through grants or donations of equipment. The organization of other types of foundations may be more complex. To understand more about the different types, visit the web page of the Council on Foundations, http://www.cof.org/.

Complementary Objectives

The type of foundation is really not as important as finding a match between the project you are trying to fund and a foundation with complementary interests. Published information from foundations, whether it is in print or on the web, usually states the purposes of the granting programs or objectives of the organization as a whole. To give yourself the best chances of succeeding in your fund quest, you should do careful research to find a foundation that shares your goals. To best understand a funders' goals, find out about programs funded in the past. It is one thing to read a foundation's mission statement, but entirely another to see what programs actually receive money.

For example, the McCarthy Family Foundation states that one of its major interests is secondary school science education, "to foster increased study of science by high school students and to promote further scientific study and careers by qualified students." See http://fdncenter.org/grantmaker/mccarthy/guide.htm. To understand what this means, you can go to a grants list and find out where money has been awarded. One program that received money from this program is BE WiSE (Better Education for Women in Science & Engineering). BE WiSE works to involve middle school girls in science with engaging activities after school. Visit their web site:
http://www.sdsa.org/bewise/whodunit.html.

Geography also matters—many foundations fund programs in specific areas where they are located. This is especially true of community foundations, located in several states, counties, and cities. Since education is one of the primary concerns of a community, most community foundations have some kind of program for funding education initiatives.

Locating Foundation Information

Many foundations have web pages that state their purposes and the programs they fund. Public libraries have volumes of information to help, along with reference assistance. The first and best place to start your search online is the Foundation Center, http://fdncenter.org. Established in 1956, the Foundation Center is an independent nonprofit clearinghouse for information about foundations, corporate giving, and related subjects.

The Foundation Center's web page lists hundreds of foundations of all types, with application procedures and links to foundation web sites. A simple search engine makes narrowing down the choices fairly simple—you will be encouraged by the number of programs offering money or equipment for math and science education.

The general public can also visit Foundation Center libraries in New York, Washington, DC, Cleveland, Atlanta, and San Francisco for assistance in using their publications and other philanthropy-related materials. The Center offers free forums on specific topics and free orientations to their materials at the Center libraries, as well as workshops on proposal writing for a fee—about $175 a day. In addition to the physical locations and the web site, the Foundation Center also publishes directories and the *Guide to ProposalWriting*. The Center's database of foundation information is also available on CD-ROM.

The Foundation Center
79 Fifth Avenue / 16th Street
New York, NY 10003-3076
(212) 620-4230 or (800) 424-9836
Fax: (212) 807-3677

Another way to find foundation web pages is to use your favorite search engine and try different search terms, including "foundations" and "grants." Two good general places to start are Yahoo at their grants directory http://dir.yahoo.com/Education/Financial_Aid/Grants/ and About.com in their nonprofit area http://nonprofit.about.com/. As with any web research, you'll have to sift through pages and pages to find the gold. See brief descriptions of a few programs in the sidebar.

Don't settle on applying for one granting program until you have read about several different foundations. The time you put into finding the right program will be well worth it—plus you will be armed with information for your next great idea! ◉

Tracy Crow, Publications Manager at ENC, may be contacted via email: tcrow@enc.org

With a good Foundation, you can do anything!

Just to whet your appetite, here are a few descriptions of foundations with granting programs for math and science education! This list is by no means comprehensive or indicative of the wide variety of foundations in existence.

The Paul G. Allen Virtual Education Foundation
http://www.paulallen.com/foundations/
Created by one of Microsoft's founders, this organization funds programs involved in producing digital content for the purpose of distance education. The web site links to an article explaining the philosophical beliefs of the foundation, which will give grantseekers significant help in determining if there is a fit between their project and this program.

The Rural Challenge
http://www.ruralchallenge.org/
This foundation seeks to promote school reform crafted especially for rural communities and is funded in part by noted philanthropist Walter Annenberg. The thrust of this organization is encouraging educational projects that support the physical, cultural, and social settings central to the improvement effort.

Geraldine R. Dodge Foundation
http://www.grdodge.org/
With several initiatives that benefit education, many in the New Jersey area, this foundation strives to nurture the individuals and organizations responsible for creating learning opportunities for children. Specific programs include the Dodge Foundation Summer Educational Opportunity Award for Principals, where principals design a project to increase their own effectiveness. There is a similar program for high school teachers.

The Arthur Vining Davis Foundation
http://www.jvm.com/davis/
The education programs from this foundation focus primarily on innovative professional development programs for teachers of grades 9-12. In particular, programs with the potential for national impact are encouraged. An example of a current grantee is Harvard's Networked Learning Project
http://learnweb.harvard.edu/ent/

JUMP ONLINE

Direct links to all web sites are available at http://www.enc.org/focus/edtech/

Technology in the Classroom: Asking the Right Questions

Teachers must take the lead to find the best ways to use technology to enhance teaching and learning.

by Lynne Schrum, President
International Society for Technology in Education

When it comes to using educational technology in the classroom, I think it is important to ask the right questions, and I am not sure that we have done that in the past. We have wanted technology to be a magic bullet or a wand that we could wave over children to make them have perfect test scores.

Of course, nothing is that easy. We have to ask some difficult questions:

- What do we know about appropriate ways to enhance student learning with technology?
- How can technology change the nature of teaching and learning?

We are starting to see some answers, I believe. We are seeing new ways of interacting that change the curriculum. We are not just thinking about static content that fits inside a textbook. We are really thinking about a process of learning that includes all kinds of materials that students will discover on their own, that we as the designers of lessons haven't necessarily defined ahead of time.

Students Learn to Ask their Own Questions

To use educational technology effectively, teachers must create the vehicle that will encourage students to think about what they need to learn and to ask their own questions. This sounds like such an easy thing to change, but it is really very difficult.

I hear a number of teachers say that they would really like to be able to change the way they teach; they would like to do project-based, multi-disciplinary lessons because the real world is not broken down into academic disciplines.

But these same teachers say that they and their students are held accountable for getting through the curriculum before May. They have to cover an incredibly broad pool of material, and that lends itself to facts and formulas and tests. Faced with these conflicting pressures, how can teachers encourage students to ask — and investigate — their own questions?

Technology lends itself to exploration. But before we can use it effectively, we need to value exploration as real teaching and real learning. We need to recognize that if students are writing about what they are learning, if they are investigating and asking questions, if they are doing it in an authentic context, then clearly they are learning how to read and

write and think. The biggest difference, the one that might scare us, is that when students explore there is no one right answer.

Now, that does not mean that we all just run around doing what we want and end up who knows where. Activities must be carefully guided and structured, but having the technology available in a ubiquitous manner makes the difference. By that I mean that technology is the means not the end. Technology merely provides the tools to be used for authentic learning.

One of the things that we do know is that when students have technology available, they tend to move faster than we expected. So we have sixth and seventh graders doing complex systems analysis. The possibilities are endless. Students who really are excelling in a particular area can take courses online or through distance education. They can continue to learn even if their community has limited resources.

From my background in special education, I know that we must also think about equity for the student who won't be taking the most advanced courses. Technology has the potential to build on whatever skills a student possesses. When students' own interests drive the learning process, we find that they work longer and harder, they are more engaged in their learning, they are asking questions at whatever level they happen to be.

Teachers Become Life-Long Learners

To use technology for this sort of authentic learning, we have to educate teachers. We must start in preservice teacher education programs and encourage those people to come into teaching who like the ambiguity, or at least can live with it. Prospective teachers need to be helped to recognize that their jobs are not to pour content knowledge and dates and facts and figures into students' heads. Professional development for practitioners needs to model the ideal of life-long learning. When teachers recognize that they will never stop learning, they will live that ideal, and they will model it for their students.

Technology allows all sorts of possibilities for continuing education for teachers, but first they must be comfortable using it. What we know doesn't work is somebody standing at the front demonstrating how to use a computer, and then everyone goes home. We know that becoming comfortable with technology takes an intense amount of time and that educators need to have the computers at school and, typically, at home if they are truly to become users.

Teachers are very creative, very intelligent people, who quickly see the power of technology. Once they use it for their own professional lives—for keeping records, for typing documents, and for their own learning—they come up with all kinds of ways that technology can enhance what they are doing with students.

We also know that it is not enough to bring in technology either top down or bottom up—enthusiasm has to come from both directions. You have to have teachers who are eager and interested. You have to have administrators who value learning about technology as an important piece of what teachers do. All parties must recognize teachers' accomplishments in the use of technology and accept even their mistakes as an important part of the learning process.

It has become clear that educational technology is not a passing fad. Its potential is overwhelming, and we need to do it right.

When computer technology first came to schools in the 1980s, we educators stepped back and let the vendors, the software designers, and others decide what we needed and what we should buy. Now we as educators must take the pedagogical high road and demand good software and hardware.

We need to make sure that the technology we use in our classrooms is structurally sound and thoughtful and free of gender and racial bias. We really need to take the lead in using technology in a way that meets all of our students' needs. ◉

In addition to serving as President of ISTE, Lynne Schrum is associate professor in the Department of Instructional Technology at the University of Georgia. Contact her via email lschrum@coe.uga.edu or telephone (706) 542-4159.

See pages 18 and 19 for ISTE's National Educational Standards, including Profiles for Technology-Literate Students

NATIONAL EDUCATIONAL TECHNOLOGY STANDARDS

The International Society for Technology in Education (ISTE), in partnership with a number of organizations and educators across the country, has developed National Educational Technology Standards (NETS) for students. ENC has been granted permission to publish NETS Technology Foundation Standards and Profiles for Technology-Literate Students. Complete information about the NETS project is available on the Internet at http://www.iste.org/

ISTE has also, in partnership with a number of organizations including the US Department of Education, the National Council of Teachers of Mathematics, and the National Science Teachers Association, developed lesson plans for using technology throughout the curriculum. The book containing the lesson plans and technology foundation standards is *National Educational Technology Standards for Students Connecting Curriculum and Technology*. See ordering information at the end of this article.

Technology Foundation Standards for All Students

The technology foundation standards for students are divided into six broad categories that provide a framework for linking performance indicators found within the Profiles for Technology-Literate Students to the standards. Teachers can use these standards and profiles as guidelines for planning technology-based activities in which students achieve success in learning, communication, and life skills.

1. Basic operations and concepts
   - Students demonstrate a sound understanding of the nature and operation of technology systems.
   - Students are proficient in the use of technology.
2. Social, ethical, and human issues
   - Students understand the ethical, cultural, and societal issues related to technology.
   - Students practice responsible use of technology systems, information, and software.
   - Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

Profiles for Technology-Literate Students

Numbers in parentheses following each performance indicator refer to the Technology Foundation Standards category or categories to which the performance is linked. See the list of six categories above.

PreK-Grade 2

Prior to completion of Grade 2, all students should have opportunities to demonstrate the following performances:

1. Use input devices (e.g., mouse, keyboard, remote control) and output devices (e.g., monitor, printer) to successfully operate computers, VCRs, audio tapes, and other technologies. (1)
2. Use a variety of media and technology resources for directed and independent learning activities. (1, 3)
3. Communicate about technology using developmentally appropriate and accurate terminology. (1)
4. Use developmentally appropriate multimedia resources (e.g., interactive books, educational software, elementary multimedia encyclopedias) to support learning. (1)
5. Work cooperatively and collaboratively with peers, family members, and others when using technology in the classroom. (2)
6. Demonstrate positive social and ethical behaviors when using technology. (2)
7. Practice responsible use of technology systems and software. (2)
8. Create developmentally appropriate multimedia products with support from teachers, family members, or student partners. (3)
9. Use technology resources (e.g., puzzles, logical thinking programs, writing tools, digital cameras, drawing tools) for problem solving, communication, and illustration of thoughts, ideas, and stories. (3, 4, 5, 6)
10. Gather information and communicate with others using telecommunications, with support from teachers, family members, or student partners. (4)

Grades 3-5

Prior to completion of Grade 5, all students should have opportunities to demonstrate the following performances:

1. Use keyboards and other common input and output devices (including adaptive devices when necessary) efficiently and effectively. (1)
2. Discuss common uses of technology in daily life and the advantages and disadvantages those uses provide. (1, 2)
3. Discuss basic issues related to responsible use of technology and information and describe personal consequences of inappropriate use. (2)
4. Use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum. (3)
5. Use technology tools (e.g., multimedia authoring, presentation, web tools, digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create products for audiences inside and outside the classroom. (3, 4)
6. Use telecommunications efficiently and effectively to access remote information, communicate with others in support of direct and independent learning, and pursue interests. (4)
7. Use telecommunications and online resources (e.g., email, online discussions, web environments) to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom. (4, 5)
8. Use technology resources (e.g., calculators, data collection probes, videos, educational software) for problem-solving, self-directed learning, and extended learning activities. (5, 6)
9. Determine when technology is useful and select the appropriate tool(s) and technology resources to address a variety of tasks and problems. (5, 6)
10. Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources. (6)

iste International Society for Technology in Education
Teachers Helping Teachers Use Technology in the Classroom

3. Technology productivity tools
   - Students use technology tools to enhance learning, increase productivity, and promote creativity.
   - Students use productivity tools to collaborate in constructing technology-enhanced models, preparing publications, and producing other creative works.

4. Technology communications tools
   - Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
   - Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

5. Technology research tools
   - Students use technology to locate, evaluate, and collect information from a variety of sources.
   - Students use technology tools to process data and report results.
   - Students evaluate and select new information resources and technological innovations based on the appropriateness to specific tasks.

6. Technology problem-solving and decision-making tools
   - Students use technology resources for solving problems and making informed decisions.
   - Students employ technology in the development of strategies for solving problems in the real world.

A copy of the print version of NETS is available as a stand-alone copy and as part of the lesson plan book, National Educational Technology Standards for Students—Connecting Curriculum and Technology. *To order, contact ISTE:* ●

ISTE Customer Service
480 Charnelton Street
Eugene, OR 97401-2626
Toll-free: (800) 336-5191
Fax: (541) 302-3778
Email: cust_svc@iste.org
http://www.iste.org/

Grades 6-8

Prior to completion of Grade 8, all students should have opportunities to demonstrate the following performances:

1. Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use. (1)
2. Demonstrate knowledge of current changes in information technologies and the effect those changes have on the workplace and society. (2)
3. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse. (2)
4. Use content-specific tools, software, and simulations (e.g., environmental probes, graphing calculators, exploratory environments, web tools) to support learning and research. (3, 5)
5. Apply productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum. (3, 6)
6. Design, develop, publish, and present products (e.g., web pages, videotapes) using technology resources that demonstrate and communicate curriculum concepts to audiences inside and outside the classroom. (4, 5, 6)
7. Collaborate with peers, experts, and others using telecommunications and collaborative tools to investigate curriculum-related problems, issues, and information, and to develop solutions or products for audiences inside and outside the classroom. (4, 5)
8. Select and use appropriate tools and technology resources to accomplish a variety of tasks and solve problems. (5, 6)
9. Demonstrate an understanding of concepts underlying hardware, software, and connectivity, and of practical applications to learning and problem solving. (1, 6)
10. Research and evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems. (2, 5, 6)

Grades 9-12

Prior to completion of Grade 12, all students should have opportunities to demonstrate the following performances:

1. Identify capabilities and limitations of contemporary and emerging technology resources and assess the potential of these systems and services to address personal, lifelong learning, and workplace needs. (2)
2. Make informed choices among technology systems, resources, and services. (1,2)
3. Analyze advantages and disadvantages of widespread use of and reliance on technology in the workplace and in society as a whole. (2)
4. Demonstrate and advocate for legal and ethical behaviors among peers, family, and community regarding the use of technology and information. (2)
5. Use technology tools and resources for managing and communicating personal/professional information (e.g., finances, schedules, addresses, purchases, correspondence). (3, 4)
6. Evaluate technology-based options, including distance and distributed education, for lifelong learning. (5)
7. Routinely and efficiently use online information resources to meet needs for collaboration, research, publications, communications, and productivity. (4, 5, 6)
8. Select and apply technology tools for research, information analysis, problem-solving, and decision-making in content learning. (4, 5)
9. Investigate and apply expert systems, intelligent agents, and simulations in real-world situations. (3, 5, 6)
10. Collaborate with peers, experts, and others to contribute to a content-related knowledge base by using technology to compile, synthesize, produce, and disseminate information, models, and other creative works. (4, 5, 6)

HELP! I JUST GOT MY FIRST COMPUTER!

Okay, so you just read the material from the International Society for Technology in Education (page 18-19) and realized your own computer skills are below those expected for students in PreK through Grade 2. Don't panic. ENC's Associate Director of Publishing offers advice to novices.

by Gay Gordon, ENC Publishing

A funny story from the customer service unit of a large technology company circulated by email a couple of years ago. The staff in the unit took calls from customers who were having problems, and they listed in the email some of the questions they had been asked. Among them:

> "I can't get the cup holder on my computer to come back out—you know, that thing that slides out with the hole in the middle."

And:

> "I've been stepping on the foot pedal for my computer and nothing happens." When asked what foot pedal, the person responded, "The small one connected by a cord to the keyboard."*

If you don't see the humor in these questions, or if you've asked similar ones yourself, this article is for you. Perhaps you have a computer that is gathering dust in your classroom, or maybe you have not even taken it out of the box. You may have good intentions but no idea where to go for assistance. Or, you may strongly resent that you have one more thing to learn, especially if the district forgot to provide a technology coordinator for your school or maybe even forgot to hire one for the district.

In a recent report by the National Center for Education Statistics, only 20 percent of teachers feel proficient enough in using technology to integrate it into their classroom activities. In addition to the lack of financial support described in the box on the following page, learning how to use a computer takes time, and time is in short supply for every teacher. Given the limitations of time and support:

- What should you learn about a computer to maximize the little time you have available?
- Where can you find help?

What should you learn?

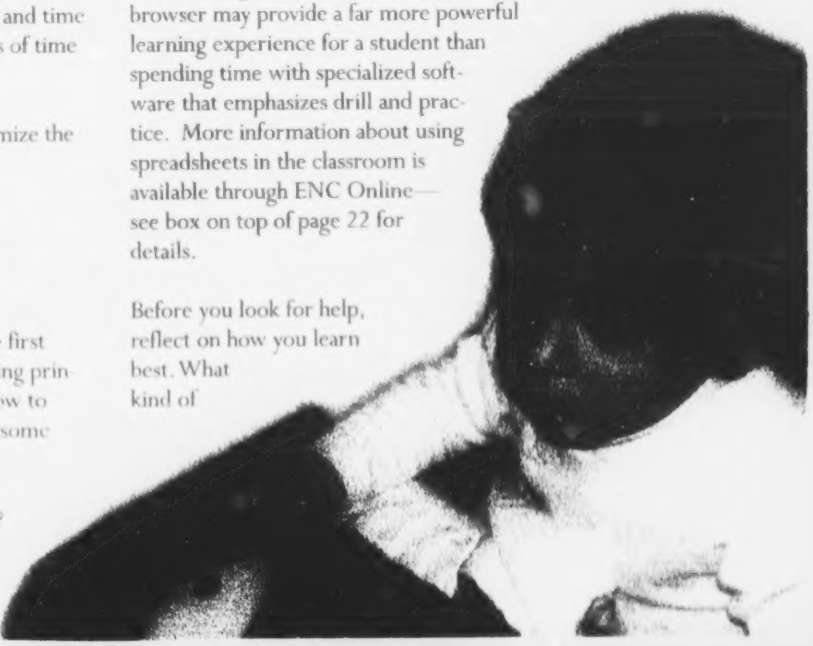
If you are given a computer to use in your classroom, the first things that you need to learn are the fundamental operating principles such as how to turn it on, how to load software, how to connect to a network (if one is available), and how to do some basic troubleshooting. The second part of this article provides suggestions for where to find help with these fundamentals if you find yourself facing your new computer all alone. If the computer you use is located in a lab at school, it is more likely that you have a person to turn to for some help, but it will still be beneficial to you to build your own knowledge of computer basics.

Several years ago, ENC published an article from a researcher who worked with teachers who were novice computer users. He found the most successful were teachers who first learned to use software that helped them improve their personal productivity. Then, the teachers were able to expand their repertoire and use specialized software with their students for particular subject areas or to accomplish particular tasks.

There are five types of basic productivity software that would be useful for you to learn: word processing, spreadsheets, presentation software, email software, and an Internet browser. You may not need them all. If you do not have a need to project presentations, then you may not need to learn presentation software. If you don't have email and/or aren't connected to the Internet, then you don't need the software for these activities. You do not have to start out by learning to program or to create your own page on the World Wide Web. If you choose to make technology a priority, you can learn those things later.

Productivity software can also be the most useful applications for students as you begin to integrate technology into your classroom. Using word processing, spreadsheets, or a browser may provide a far more powerful learning experience for a student than spending time with specialized software that emphasizes drill and practice. More information about using spreadsheets in the classroom is available through ENC Online—see box on top of page 22 for details.

Before you look for help, reflect on how you learn best. What kind of



Are you wondering what the cup holder and the foot pedal are? The CD-ROM holder and the mouse!

learner are you? Perhaps you've already analyzed your own learning style when you developed sensitivity to the learning styles of your students.

Why Teachers Struggle with Technology

According to a recent study by the CEO Forum on Education and Technology, a group of business and education leaders based in Washington DC, schools will spend $88 per student on computer equipment in 1999 but only $6 per student on professional development to help teachers use technology in the classroom.

In contrast, the state of California has given grants to 689 high schools to invest in technology. Grants average $310,000 per school with a stipulation that 30 percent of the funds go toward technical training for teachers.

Based on a news item published online in the Silicon Valley News, *May 11, 1999. For current news on this site, visit:* http://www.mercurycenter.com/svtech/news/breaking/

For many people, it is very important to actually get their hands on a computer and try it out. It is best to work on the computer you will regularly use or on a similar model because it can be confusing to learn on one operating system and then switch to another. If a demonstration is sufficient for you, then you can seek out some general instruction. If you learn well by reading, then by all means visit the bookstore or library. The Focus on the Collection section (p. 40) provides a list of resources that will help you get started.

Don't be afraid to experiment! You may have heard horror stories about computers crashing, people losing all their computer files, and therefore losing hours of hard work. All these things can happen, but you need to put them into perspective. Since you are just starting out, you have yet to put in hours of hard work, so losing a file is not a catastrophe. Try to be fearless as you experiment with software. A lot can be learned through trial and error—so don't be afraid of your errors!

Where can you find help?

Call on people you know.
The best possible situation for any teacher learning to use a computer is to have a technology coordinator or resource person in the building whose only job is to help teachers learn what to do. Unfortunately, very few schools have technology coordinators, and those few people are frequently overworked and unavailable when you need them. If you do not have a technology resource person readily available, you may have to be creative in your search for help.

Next to an on-site technology coordinator, fellow teachers are your best resource. If there are one or two people in your school who you can go to with questions and who are willing to spend time with you, you are in luck! Their instruction is individualized to fit your needs, rather than generalized to meet the needs of a class. But be respectful of their time, and remember that you want to learn, not have them perform the tasks for you. As they answer your questions, be sure to take complete notes to turn into a "cheat sheet" that will remind you of the steps to take to accomplish various tasks on your own.

Ask your students and their parents for help. You may have a mom or dad who would be happy to give you some lessons, or better yet, you may have a student who can help you. You both will learn from switching roles. As with a fellow teacher, be careful that you don't have the student or parent do the tasks for you instead of learning how to do them yourself.

Find other free or low-cost sources of help.
Maybe there is someone outside your school but in your district who can help. Ask or call around. Very few districts buy computers without getting a contract to provide some basic instruction, but it may be too general for your particular needs. If there is a resource person who can answer your specific questions, that is best.

Check on the availability of Tech Corps volunteers in your area. Tech Corps is a national nonprofit organization focused on improving K-12 education by building and facilitating partnerships between technology volunteers and schools to empower teachers and students to use technology effectively. To find out more about the location of Tech Corps volunteers, visit their web site http://techcorps.org/ or see contact information at the end of this article.

Your computer and/or software came with a manual that explains its basic operation. If you are the type who learns well through reading, these manuals may be helpful, although many of them are written in technical language. Another problem is that a computer may appear in your room without the manual, especially if it is an older model. In that case, go to the library or a bookstore. Several series of books teach computer basics (if you aren't offended by being called a "dummy"), and there are racks full of computer magazines, including some specifically for teachers.

You also might try using the computer tutorial that came with your computer and/or software. This often-overlooked resource can be very effective because you are actually moving step-by-step through the instructions using your own equipment.

Invest in courses or workshops.
Is there a university, college, or technical school in your community that offers basic computer classes? Be careful, because at the beginning you do not need to take a programming class. You are looking for a class that teaches you about particular productivity software or in very general terms about computing. Talk to the instructor if you are not sure whether the class is right for you.

Many communities have interest groups that meet regularly to discuss computer-related issues. The level of discussion at their meetings may be beyond you, but through the group, you may find someone in the community who is willing to work with you. The group may also conduct workshops that you can attend for a fee. Interest group meetings and contact people may be listed in the newspaper or telephone book, or you may be able to find out about them through a local store that sells computers.

Computer stores often provide instruction. Sometimes you have to have purchased the computer from them to sign up for classes, but store salespeople can be a good source of information. You should keep in mind that stores want you to buy something, and you may be strongly encouraged to make purchases while you are there.

Once you've learned the basics, teach someone else.

You know that the best way to learn something is to teach someone else. All the other novice computer users in your school are struggling with the same things you are. Why not take the lead to set up a time to teach them what you have learned and to learn from them as well? You will feel more secure in your own learning, and you will have someone to share your struggles. ●

Visit ENC Online for More Information

As mentioned in this issue's Editorial (page 4), the print version of *ENC Focus* cannot possibly contain enough pages to cover every aspect of Integrating Technology in the Classroom. That is where the electronic version of the magazine comes in.

Visit http://www.enc.org/focus/edtech/ for "Information Technologies in Science and Mathematics Education," Robert Tinker's article containing information about using spreadsheets, the "single most valuable information technology tool" for mathematics and science education. Thanks to the limitless capacity of the Internet, you will be able to link from Tinker's article to "You Can Do Anything with Spreadsheets," which illustrates the versatility of this computer application. Spanning content from first grade to graduate school, examples include graphing, data analysis, and modeling.

Even if you are new to the World Wide Web, you will find that ENC Online will help you make sense of this exciting, but complex, universe of ideas.

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Two additional articles about Integrating Technology in the Classroom are available in the online version of this magazine.

Evolving with the Internet: Taking Technology for Granted—Finally
by Kristine Mueh
A science teacher in Boulder, Colorado, who has used computers with students for years, reflects on how advances in technology have increased its value in the classroom. See it now at:
http://www.enc.org/focus/edtech/

Using Technology and Real-World Connections to Teach Secondary Mathematics Concepts
by Hollylynne Stohl Drier, Kara M. Dawson, and Joe Garofalo
Some specific advice on how to use technology to make math relevant to students. See it now at :
http://www.enc.org/focus/edtech/

BEYOND POINT AND CLICK:

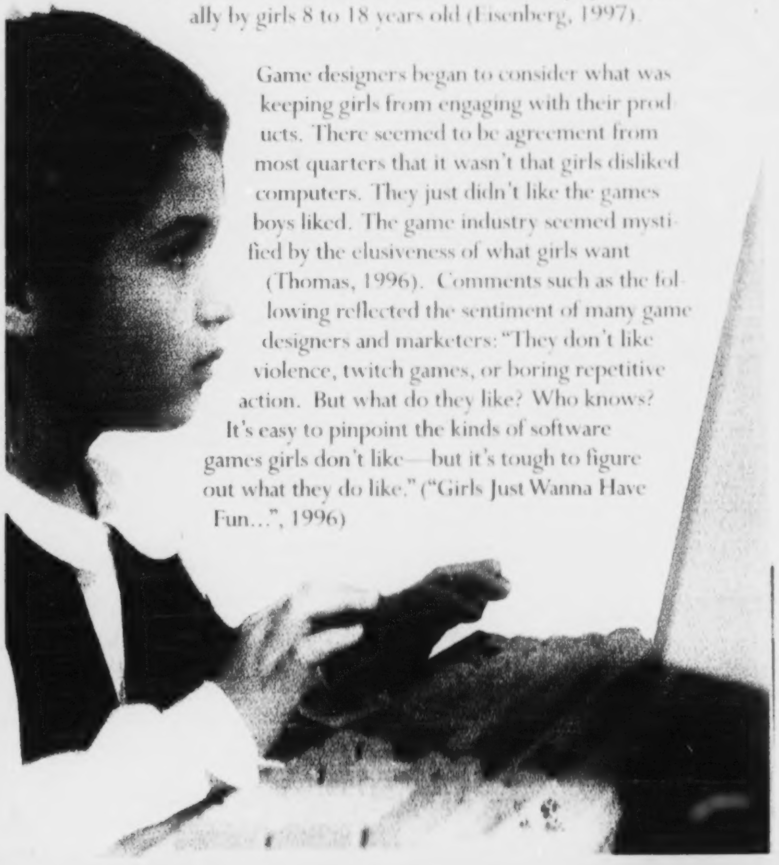
The Search for Gender Equity in Computer Games

Want to get girls interested in computers? Are "games for girls" the way to go? What does a good educational game look like? The article below and the material in the sidebar provide a few answers from an NSF-funded research project.

by Megan Murray and Marlene Kliman, Education Research Collaborative in Science and Mathematics

Throughout their brief history, computer games have been significantly more popular with boys than with girls. Since boys spend an enormous amount of time and money on computer games, the games have been designed to include characteristics boys like: high levels of competition, confrontation, and violence; fast, repetitive action; beating the clock; and racking up points to achieve a high score. Positive female portrayals are few (Provenzo, 1991; Chappel, 1996). Several years ago, designers and marketers of computer games began to see girls as an untapped and potentially lucrative market. The industry wasn't reaching half the population—and the $57 billion of their own money spent annually by girls 8 to 18 years old (Eisenberg, 1997).

Game designers began to consider what was keeping girls from engaging with their products. There seemed to be agreement from most quarters that it wasn't that girls disliked computers. They just didn't like the games boys liked. The game industry seemed mystified by the elusiveness of what girls want (Thomas, 1996). Comments such as the following reflected the sentiment of many game designers and marketers: "They don't like violence, twitch games, or boring repetitive action. But what do they like? Who knows? It's easy to pinpoint the kinds of software games girls don't like—but it's tough to figure out what they do like." ("Girls Just Wanna Have Fun...", 1996)



Criteria for Choosing Computer Games for Girls and Boys

By Megan Murray and Marlene Kliman

Finding computer games that are engaging and educationally rich for children—both girls and boys—is a difficult task. Our research has suggested three criteria to consider:

> **Is the game educational?** Does it encourage problem solving? creativity? the development of important strategies or skills?
> **Is the game equitable?** How accessible and engaging is the game to both girls and boys? Are there features that particularly appeal to (or deter) girls or boys?
> **Is it a good game?** Is it fun? Is it challenging without being overly frustrating? Does it encourage persistence?

Using these criteria to examine computer game software reveals that there is little of educational substance in most computer games. While many of these games may be appealing initially, few offer educational content of any depth or engage children over time. Children who play these games may be learning how to point and click, but they are not becoming competent with computers in ways that will support their technological future.

Here are several computer games that fit the criteria; most appeal to both girls and boys:

The American Girls Premier, The Learning Company, 1997 and 1998
Escape from Dimension Q, Headbone Interactive, 1996
The Logical Journey of the Zoombinis, Broderbund, 1998
The Imagination Express Series (Destinations: Castle, Rain Forest, Ocean, Neighborhood, Pyramids and Time Trip, USA), Edmark, 1994-1996
My Make Believe Castle, LCSI, 1998
Oregon Trail, The Learning Company, 1997
SimTown, Maxis, 1994

The Through the Glass Wall project reviews computer games according to the three criteria. Visit its web site: http://www.terc.edu/mathequity/gw/html/gwhome.html.

Why should educators care about the development of computer games? Because these games have the potential to significantly affect girls' experience with and attitudes toward technology. Girls remain at a serious disadvantage to boys in their relationship with technology. Although access to computers at home is becoming more equal (Vail, 1997), girls enter school with less technological experience, use computers less outside of school, and show consistently less confidence in their computer abilities than boys. When they take computer classes, girls are more likely to take clerical classes such as data entry and word processing, "the 1990s version of typing" (AAUW, 1998).

The Advent of "Girl Games"

In recent years, there has been a great deal of research on girls and computer games. As game developers suspected, studies have confirmed that many girls dislike features typically found in computer games, such as hand-eye coordination, repetitive action, racking up points, and time pressure. Instead, many girls prefer games with in-depth narratives and characters, the ability to design or create, the possibility for social interaction both on the screen and between players, and the ability to explore different activities within the same game (Inkpen et. al., 1993; Thomas, 1996; Eisenberg, 1997; Weil, 1997; Slaton, 1998).

In response to these findings, several companies, including Girl Games Inc., Her Interactive, and Purple Moon, formed with the goal of designing games for girls. Unfortunately, many of the games they have produced focus on stereotypically female interests—romantic relationships, shopping, and fashion. For example, in McKenzie & Co. published by Her Interactive, the player's goal is to choose a boy and get him to ask her to the prom. Along the way, the player can shop at the mall, model outfits, or try on make-up. The Let's Talk about Me! series treads similar ground with activities focusing on clothing and hairstyles, astrology, diaries, and a slew of teen magazine-type personality quizzes about fashion, families, boys, and friendships.

The game most commonly acknowledged as cracking open the girls' market is Barbie Fashion Designer, by Mattel. This game, which enables players to dress and accessorize Barbie and then watch her model the outfits created, sold half a million copies in its first few months, with $14.4 million in sales as of February 1998 (Berselli, 1998). Mattel has gone on to flood the market with 15 Barbie-related technology products, from those that focus on hair, jewelry, and clothing design, to writing products, to adventure games http://www.mattelmedia.com/.

Sales of girls' games rose to almost $60 million in 1997 (up from $1.5 million in 1995), and four of the top five girls' titles were Barbie-related (Berselli, 1998). Following in Barbie's footsteps, many other girl games are based on a television program or book series already known to be popular with girls, such as *Clueless, Sabrina the Teenage Witch, The Baby-Sitters Club,* and *Madeline*. Even Segasoft, known for its stereotypical "boy games," has gotten into the mix with *Cosmopolitan* Virtual Make Over.

While many games for girls attempt some inclusion of educational topics (e.g., health and women's history quizzes in Let's Talk about Me), very few contain anything of substance. In fact, the real play of the game (for instance, finding a prom date in McKenzie & Co.) often overrides the value of any educational activities that are included. There are several exceptions. One is the American Girls Premiere, which enables children to explore dramatics, writing, and history. (See sidebar on p. 23 for criteria on choosing educational software and for a list of recommended software.)

Although it is common to hear parents, teachers, and others complain about the stereotypical nature of such games, many feel torn. They wonder if the power of these games to engage girls with technology and to teach them basic computer skills, such as how to point and click, outweighs concerns about the content. As Patricia Flanagan of Her Interactive put it, "If the product's intended audience likes it, and if it introduces them to the world of technology, then why complain?" (Beatto, 1997).

Raising Expectations

Why complain indeed? While "pink software" may initially draw girls in, many of these games fail to interest them over time in challenging and educational activities. If we want girls to become truly engaged in technology and more proficient with its use, we need games that not only appeal to girls, but also call on their intellectual curiosities and capabilities.

In fact, there are educationally rich games that appeal to girls, but they're not "girl games" based on stereotypes. For example, Logical Journey of the Zoombinis (see Figure 1) is a game with appealing characters (small blue creatures called Zoombinis), an engaging story (shepherding the Zoombinis through a variety of puzzles to a new homeland where they will be safe and free), and a design area (where players create Zoombinis with particular hair, eyes, nose colors, and modes of transportation). Zoombinis is built around a varied set of 12 puzzles that draw from the mathematics of attributes, set theory, and logic. Playing these puzzles encour-

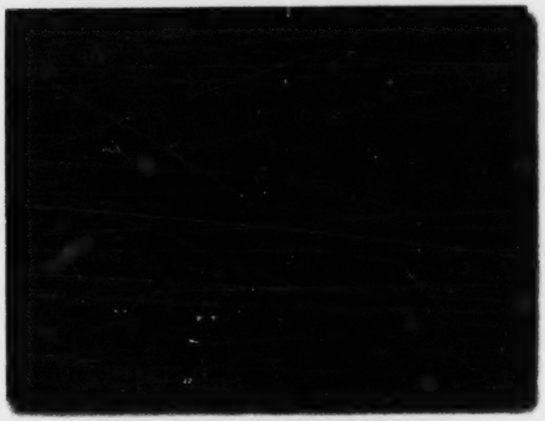


Figure 1: Screen from Zoombini game.

ages children to develop and test hypotheses, acquire and use evidence, and refine and adapt hypotheses. The puzzles are challenging and complex. There is no time pressure and no need for speedy hand-eye coordination.

In the following dialog, C and E, two third grade girls, are playing a Zoombinis pizza puzzle that involves making conjectures, developing and testing hypotheses, and keeping track of information to solve a problem. Players have a limited number of chances to satisfy a very picky (and hungry) troll with "the perfect pizza," by making pizzas with different combinations of toppings. The troll's preferences remain constant through one playing of the puzzle, but change with each new round. The girls in this dialog are interested in the puzzle and intellectually engaged in solving it. They are motivated to make several attempts and ask for help, and they persevere in the face of frustration.

As they begin, the girls are eagerly anticipating the puzzle. E hopes for a puzzle that includes an item she enjoys in real life. C hopes the puzzle will be easy.

> C: With ice cream?
> E: (hands clasped as in prayer) Please be ice cream, please be ice cream…
> C: No—please no be ice cream.
> E: Please be ice cream. Ice cream's so much better than pizza.
> C: No they're both too. . . . (You have to satisfy the troll with) Ice cream AND pizza. . . . Oh phew. There's no ice cream…

C begins with a common first strategy—try to remember the combination that worked last time. E tries the toppings C suggests, but discovers that the troll had changed his preferences.

> C: …Oh! Last time we did it, I think it was (pointing) this, this, and that.
> E: (with mouse) This?
> C: This . . . meatballs (E: This?) thing. Yeah. And that. (And that?) Yeah.
> E: Oh he changes it. It could be anything.

E uses data to reason about and test different hypotheses. She tests C's theory—trying what worked last time and what worked in a neighbor's game. Since that doesn't work, she looks for more data. She carefully checks the rejected pizzas, thinking about and trying to keep track of which toppings (and combinations of toppings) were tried, accepted, and rejected, and what that means about what the troll wants. C continues to engage with the story and characters by imitating the troll.

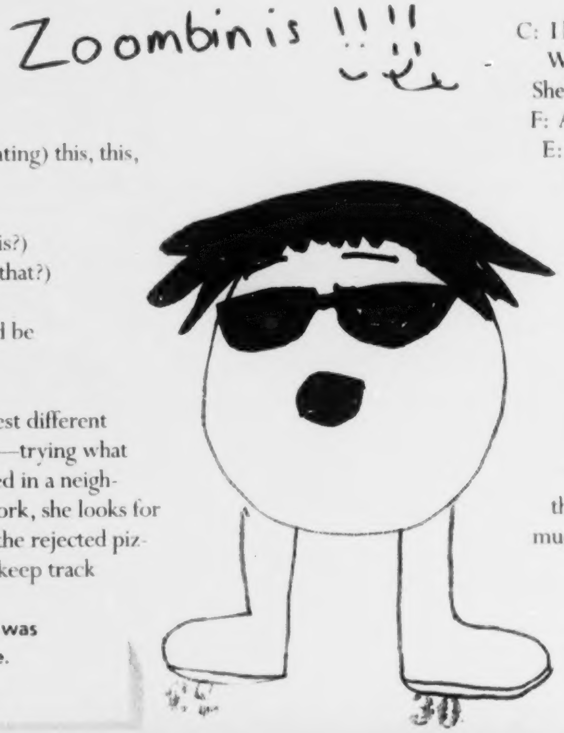
> E: It must. . . . It must be mushrooms. No, it's that! It's the underneath stuff (the cheese). So . . . it could be that, that. . .uh. . . (She tries mushrooms, sausage, and peppers.)
> Game: Ewww. Yuck!
> (The troll rejects the pizza.)
> E clicks on the troll, making him holler, "Make me a pizza!"
> C: Look at his mouth. (pointing) Maaa-aahhh.
> E: Here you do it. I can't do it.
> C: You think I can?!
> E: (laughing) Ah, you can try.
> C clicks a lot of toppings.
> E: What are you doing?! That's not gonna work.

C searches out help in the form of F, a known Zoombinis expert. E continues to analyze the data available to her, realizing she has already eliminated one of the toppings F suggests. Although F reinforces the idea that the troll wants something different every time, C still wants to try something that worked before.

> C: F? . . . What did you do for beating the pizza?
> F: It's not the same every time though.
> C: I know, but what did you do? It might work. What did you do? (Brings F over.) Listen to F. She beat it.
> F: All four the last ones. (E: What?) The last four.
> E: This, that, that, and that? (F: The last four on the list.) This, that, that, and that?
> C: F! F! (pointing) This, that and that and that? (F: Mm hmm.)
> E: But he doesn't like these.
> F: Well that's what it was on mine.

C and E are frustrated, but their engagement with the story, characters, and puzzle keeps them persisting.

While children playing Zoombinis focus on the mathematics of attributes and logic, there is much less of an educational emphasis in children's interactions with many games for girls.



The student artwork on this page was inspired by the Zoombini software.

Rockett's New School is a fairly typical example. The educational content is mainly social (role-playing and decision making in the context of friendships and relationships). The game is fairly stereotypical in its attempts to appeal to girls—from the flowery T-shirt, doll, and tube of lipstick that comes with the package, to decisions such as which clique to join or which locker to snoop through.

The story involves the player in Rockett's first day of eighth grade at a new school. Periodically, the story is interrupted, and the player is asked to make a decision about how Rockett would respond to a particular problem or situation (such as where to sit in the lunchroom). Three bubbles appear, representing the choices available, each with a picture of Rockett feeling a different way (e.g., a happy-looking Rockett, a mad-looking Rockett). Generally, the choices include a brave/happy/confident choice, a nervous/shy choice, and an angry/depressed choice. Players click on the bubble they want, and the story continues based on that choice.

Making thoughtful decisions is the educational focus of Rockett's New School, but given the complicated nature of these kinds of social decisions, three possibilities can be rather limiting. In fact, children will sometimes play in a capricious way (for example, choosing only a particular kind of response), since players must sometimes choose an option that doesn't fit the way they would really respond. Here is a snippet of a conversation among three girls playing this game:

E: Are we gonna make all the bad decisions?
J: No, all the mad decisions—here I'll show you the face.
S: The flat-line mouth one.

The impact of one's choices on the story are artificial. For example, if you choose to be nice to Mavis (a girl who's not part of the "cool" crowd), you help her open her locker, and if you don't, you have an unpleasant interaction with her. But, either way, you end up at the same point—the door to your homeroom—with the same three choices.

The girls in the dialog above were initially turned off by the stereotypical nature of the packaging, reading the box sarcastically and making comments like "I'd rather barf," "It's stupid," and "I won't play it, because if there's a doll in the box I won't play it." Although they became engaged with this game for an hour or so, there was little left to explore by the end of that session. The first time through the story, they responded to the choices in the ways they would genuinely react—confident sometimes, shy at others. Then, they played by choosing the same type of response for each choice (all the happy/confident ones or all the angry/depressed ones). Unlike Zoombinis, which offers children new versions of puzzles each time they play and new opportunities to develop, refine, and apply strategies, this game is exactly the same each time and can quickly become tiresome.

Making Good Choices

When choosing computer games, teachers and parents need to remember the three criteria listed in the sidebar on page 23: the educational content of a game, the features that make it more (or less) equitable, and the factors that make it more (or less) fun and engaging to play.

While there is little of educational substance in the genre of games for girls—or, for that matter, in the games developed for boys—there are games that appeal to girls and boys that also offer significant opportunities to investigate real content in mathematics, science, and technology. The Through the Glass Wall project is attempting to identify and describe equitable and educationally rich games on its web site:
http://www.terc.edu/mathequity/gw/html/gwhome.html.

By providing thoughtful, detailed, and accessible information, we in the educational community can hope to influence buying decisions, raise consumer standards, and make a difference in the lives of girls. ●

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The ideas presented in this article are largely a result of the NSF-funded research project Through the Glass Wall: Computer Games for Mathematical Empowerment (Grant # RTL9555641). To evaluate the content of such games and children's interactions with them, project researchers spent three years examining educational computer games and children's play sessions with them.

Megan Murray is a research associate on the Through the Glass Wall Project. She is also working on a project that is helping districts successfully implement reform-based math curricula. Marlene Kliman is a scientist at TERC. Her work focuses on developing materials that support parents in doing mathematics with their children.

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DIARY OF AN EDUCATIONAL TECHNOLOGIST

Educational technologist is a new role that is being defined in school districts at the cutting edge of technology integration. Provided here are excerpts from an article that explains how it works in a real school system.

by Judith Davidson Wasser, Kevin McGillivray, and Elizabeth T. McNamera

Kevin McGillivray, a teacher in the DoDEA (Department of Defense Education Activity) school system serving dependents of military personnel, is one of the first of a new breed of educational technologists in his school system, and, indeed, in any American school system. He is neither a computer lab teacher nor a district technology coordinator. His job encompasses both, and much more, and emphasizes the connection of the technology to the curriculum.

From the beginning, McGillivray has been documenting his activities daily in an electronic log, which he shares with researchers at TERC. These logs have been folded into a much larger study of the scope and impact of the technology integration process. McGillivray's role has become a case study within the overall research. His work intersects with the four inter-connected arenas of educational reform:

- educational practice,
- professional culture,
- technology leadership and management, and
- school community and family involvement.

This article draws upon excerpts taken directly from McGillivray's logs to present a view of the complex support the educational technologist provides to the full school community. (Note: just a few samples are provided here. The entire article is available via ENC Online: http://www.enc.org/focus/edtech/)

Supporting Technology Integration in Educational Practice

3/31/98
12:00. Linda brought her kindergarten class to the lab and Dirk brought his 5th grade class to assist them. I had logged them in before they arrived. They had organized a short project together with Dirk's kids doing the assisting. Using Kpix, the kinder kids were to "write" about themselves assisted by the 5th graders. When the kinder kids left, I worked with Dirk's kids, showing them some new things about PowerPoint for their presentations.

As an educational technologist, McGillivray's goal is to help teachers "learn to fish." To that end, he serves as a technology coach or mentor as they learn to use the new technologies. Although teachers leave their classes with music, art, or physical education specialists, they are expected to be present when McGillivray is working with their students. They take advantage of the time to learn about ways of teaching with the technology.

Providing Professional Development and Strengthening Professional Culture

2/5/98
[Professional Development Day in four schools]

8:00. Inspiration workshop in the HS computer lab. About 8 middle and high school teachers. Went well—teachers really liked it.

10:30. Helped HS teachers in their rooms—worked with 6.

12:00. To Argonner [the elementary school]. Spent the rest of the day in the lab helping teachers with whatever they wanted to work on... Lots of teachers, lots of different software, lots of questions!

The educational technologist anchors a range of formal and informal professional development opportunities. Formal opportunities include summer training, full-school professional development days, and after-school and weekend training sessions. Informal professional development opportunities can include email messages that identify web resources, or checking in with teachers to find out how their work is going and how they are using specific software tools.

To be successful, the educational technologist must carefully balance informal and formal opportunities. Beginners, middle-level users, and advanced users all need invitations to participate that meet their current level of expertise and further their learning.

Supporting Technology Leadership and Management

10/24/97
8:00. Met with Arnie, Mel, and Susan in my office. We discussed the upgrades, overdrive processors, netra upgrades, the dead/incomplete drops at the 4 schools, the "computer problem" mailboxes at the schools, and the problems with networking the Macs. This was a techie day for me. Nearly the full day was spent working on computers and solving problems.

A fully networked school is a complex technical entity. Not only are there the issues of hardware, software, and network maintenance, but there are also critical issues concerning usage such as user passwords and access, log-in procedures, and server space.

McGillivray works closely with the technical staff serving the four schools in the district. Although he provides technical help to teachers and principals on a daily basis, the primary focus of his job is to help teachers integrate technology into content lessons.

5/1/98
3:00. The high school principal is using another PowerPoint for today's faculty meeting—she is also using her laptop computer this time. I helped her get the equipment set up. She says she wants to "walk the walk" as well as "talk the talk" about technology in her school.

While learning to integrate the new tools in their own work, principals must support teachers, who are also learning. They must know enough about the equipment to be able to oversee the purchase, placement, maintenance, and continued technical planning in the school.

Few principals received preparation for these tasks in their school or work experience. The educational technologist can provide principals with important support for learning the equipment and understanding the new issues.

Supporting Family and Community Participation

1/26/98
8:00. To Sportfield to help Virginia [a parent volunteer leading the workshop] get the parent workshop going. Back at noon to work with them in the afternoon. Virginia is doing a good job! We need to remember her good work with these workshops at the end of the year.

During the 1997-98 school year, more than 100 parents received training in the technology tools available in McGillivray's Department of Defense district. For their efforts, they received a certificate (good for promotion reports and future employment within the military service).

As payment for the training, they were asked to give back in-kind to the schools. Parent volunteers were frequently present that year in classrooms and in the computer labs, helping teachers use the new software applications in various content areas. In this way, parents were also introduced to curriculum areas, gaining deeper knowledge of what students need to know and why.

Conclusions

TERC's study of McGillivray's role demonstrates the importance the educational technologist plays in connecting the systemic arenas of technology integration in networked schools. As educational technologist, McGillivray is the one person in the cluster of four schools with the mandate to move within and across these arenas, drawing them together in meaningful relationship to each other. If networked schools are to thrive and derive the greatest possible advantage from the new technologies, it is critical that they assign individuals such as McGillivray to the educational technologist role. ●

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The complete version of the article, "Diary of an Educational Technologist" was published in *Hands On!* the newsletter of TERC, a not-for-profit education research and development organization dedicated to improving mathematics, science, and technology teaching and learning.

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ENC would like to thank TERC for permission to publish excerpts from the article, which is available in its entirety via TERC's web site:
http://www.terc.edu/handson/f98/diaries.html
The article can also be accessed via the electronic version of this publication: http://www.enc.org/focus/edtech/

WANT A WEB SITE? Let Students Take Charge!

High school students learn computer skills and gain confidence while creating worthwhile web sites.

Chain of Students Keeps Class Site Going

by Jessica Byrd, Student Web Master, Cascade, Idaho

Working on the web page for the advanced biology class at Cascade High School has definitely added to my knowledge of computers. When I was asked if I wanted to work on the web page, I knew next to nothing about them. During the last semester of my sophomore year, I was taught how to design and upload web pages by Ben Plehal, a departing senior and winner of the National Technology Leadership Competition.

I learned many useful skills including how to run various computer applications, including Golive Ciber Studio, Scanwizard, and BBEdit, that I had never operated before. As my sophomore year progressed so did my confidence and computer know-how. I became more and more comfortable with the applications I was running on the computer, and by the end of my sophomore year, I was so confident in my skills that I knew I could take over the web page.

I assumed leadership of the site as a junior. During that year, I acquired a sense of accomplishment that I had never felt before. I was in charge of creating, improving, and uploading web pages. I was very proud of myself when I created my first web page. One of the best aspects of the experience was that I could see the results of my hard work immediately.

As I continued creating and uploading new pages, that first sense of accomplishment never left me. Even now, during my senior year, I still feel excited every time I upload a new page. I have also begun training a sophomore who will take over the web site when I graduate this year.

I feel as if I have really left my mark on Cascade High School as the web master of the advanced biology web page. I have learned skills that will be useful in my future. Perhaps even more important than knowing how to run applications on a computer, I also know that I can do anything I put my mind to.

Students Enhance ENC Online

by Cara Spicer, ENC High School Student Intern

When looking for a summer job, I tried all sorts of places, from clothing retail to ice cream sales to full-time babysitting. I had about given up on finding the perfect place of employment, when I learned about the possibility of working as an ENC high school student intern. I would be helping to maintain a student branch of ENC Online. Before the internship began, my computer knowledge was limited to word processing and email. Working at ENC, I have had the opportunity to learn about different types of software, create web pages, and have my writing published on the Internet.

Work on the ENC student web site started in the summer of 1998. One of the high school students who created it, Jared Campbell, is still involved. Over the winter, changes were made in the programming, and student-written reviews of educational materials in the ENC collection were added to the database. At the beginning of the summer of 1999, when I began my internship, the design of the web page was basically complete. My job has been to add to the database of reviews.

Our reviews are written to help instigate a student-oriented curriculum in school systems. The abstracts ENC professionals provide for ENC's Resource Finder are based solely on facts, whereas the student web site contains students' thoughts on different educational materials. After all, we are the ones who actually use the materials in the classroom. Our work is aimed toward students, parents, teachers, and administrators interested in hearing students' input in education.

We base our opinions on our own research and by exploring the resources at ENC. We then write a critique of the material and rate the resource on a scale of one to five. We consider four different standards: ease of use, educational value, fun/interest, and appearance/design. We give the material an overall rating based on these four categories.

My summer internship at ENC has been both educational and rewarding. I now feel confident in my computer skills and will apply this knowledge to my classes at school. I have also helped people to realize that high school students do care about their education and are willing to help improve it.

JUMP ONLINE!

Visit the Cascade High School web site at http://www.cascadehs.csd.k12.id.us/advbio/home.html
Visit the ENC student site at http://www.enc.org/students/

THE SHAPE OF THINGS TO COME

Teacher collaboration eases the use of technology in the classroom. This veteran teacher describes how she and a colleague used computer software to teach geometric reasoning to elementary students.

by Linda S. Hallenbeck, Fifth Grade Teacher, Hudson, Ohio

Computers can be a powerful tool to enhance learning in geometry. However, trying new curriculum materials and learning computer applications at the same time can also be overwhelming for teachers. I have found that collaboration with fellow mathematics teachers can ease the process. The result is learning not only for the students, but also for the teachers.

Recently I was involved in such a collaboration with another fifth grade teacher of mathematics at East Woods School in Hudson, Ohio. I had previously used computers to teach a two-dimensional geometry unit, but had no colleague with whom to discuss classroom discourse and students' learning and thought processes. My colleague, Maria Regan, was eager to try something new.

We saw our endeavor as a chance for both of us to benefit. Maria saw this as another opportunity to learn more about children's geometric reasoning while also learning a new computer program. I anticipated that the discussions we would have about our students' development would give me more insight into my students' thinking and thus improve my teaching.

Maria and I discussed a plan to allow her time to learn the computer program and then to discuss the teaching strategies involved in its use. We decided to begin by meeting for a concentrated period of time on a Sunday afternoon to experiment and delve into the computer program. This allowed us a large block of time with no interruptions, as well as a day in which we had not already used all of our brainpower teaching our students. We also decided we would talk before and after school, as needed and as our time allowed.

We selected the computer-based curriculum *Shape Makers: Developing Geometric Reasoning with the Geometer's Sketchpad* by Michael T. Battista (1998). This research-based text consists of computer tasks that, along with rich classroom discourse, develop students' thinking about geometric shapes and the characteristics or properties of specific shapes. Computers, calculators, paper and pencil, and classroom discussion are used to aid the students' thinking about properties of quadrilaterals and their classification.

Understanding Student Thinking

One of the goals of our collaboration was to study the system developed by Pierre van Hiele (1986) that describes the levels that characterize the development of students' geometric thought. (See box for a summary of the levels.) Maria and I first read extensively in van Hiele's work and in the writing of Clements and Battista (1992) before we felt ready to examine and understand the sophistication of students' reasoning. This research enabled us to:

1. have a clearer understanding of students' geometric reasoning,
2. guide teacher questioning, student thinking, and classroom discourse, and
3. assess both our instruction and student learning.

The geometry curriculum taught in high school requires students to construct formal proofs within an axiomatic system; that is, the curriculum requires thinking at van Hiele's Level 4. Often even high school students are unable to successfully accomplish these proofs because their experience has not provided the necessary opportunities to progress to this level of sophistication.

Summary of the van Hiele Levels of Geometric Thinking

Level 1: Visual
Students identify and reason about geometric configurations based on their appearance.

Level 2: Descriptive/Analytic
Students recognize and can characterize shapes by spatial relationships among their parts.

Level 3: Abstract/Rational
Students can classify shapes and give informal arguments to justify their thinking.

Level 4: Formal Deduction and Proof
Students can use an axiomatic system to justify a conclusion as a logical consequence of geometric statements.

(Battista, 1998)

Research has shown that fifth-grade students' thinking can progress from identifying shapes visually (Level 1), to property identification (Level 2), and some students are able to interrelate these properties and construct class-inclusion relationships (Level 3). When fifth graders are challenged to learn more than just identifying the shapes visually, they begin to build the necessary foundation that will allow them to construct formal proofs in geometry.

The Shape Maker computer program provides meaningful tasks that consistently challenge students to examine their current thinking. This perturbation causes students to attempt to bring about resolution to the mental conflict. They must make necessary abstractions from the current situation and then change their thinking to accommodate their new conjectures. As a result, the students' geometric thinking rises to a higher level of sophistication.

Fostering Classroom Interaction

Maria and I worked together to develop skills to encourage this type of exploration. The role of the teacher becomes one of posing questions, offering students support when needed, but always asking for students to justify their geometric conjectures. Much of the time in class is spent with the students working in pairs at their computers as the teacher travels from pair to pair asking questions and constantly challenging students to explain their thinking.

Classroom discussion is also an integral component of this style of learning. The class must formulate a consensus that is mathematically sound, yet agreeable to all. For instance, one partnership of students may have conjectured that they believe a kite always has at least one line of symmetry that will always bisect the angles, while others may not agree. In this situation, the teams who disagree may go to a computer to support their argument. One team will try to show why the conjecture is not workable, while another group sets out to manipulate the program to create various kites, identifying the line of symmetry to demonstrate validity of their conjecture.

Another class discussion that is sure to take place is that a square meets all the criterion of a rectangle, thus it is a rectangle. Since many fifth graders believe that squares and rectangles are two different, unrelated classifications of quadrilaterals and that squares are not rectangles, students may debate this issue in great length. The result is they learn much about properties and the interrelationship of properties in quadrilaterals.

Learning for Students and Teachers

Fifth-grade students are active learners who enjoy working with computers. Maria and I also found that our students gained autonomy when making conjectures and justifying those conjectures to each other. Our computer-aided geometry unit was a wonderful learning experience for more than one hundred students. However, the two teachers were equally enriched.

Maria and I spent many lunch periods, as well as before and after school meetings, in discussion and sharing of ideas. Some meetings were very short, while others were lengthy discussions of students' thinking and learning, and the implications of the students' learning for us, their teachers.

This experience has confirmed for both of us that a mentoring relationship is truly a two-way street. Both the mentor and the mentee benefit from the rich dialog, the sharing of ideas, and the enhancement of professional development that has a favorable impact on children. We look forward to sharing with others what we have learned through our joint growth process. ◉

Linda S. Hallenbeck is President of the Ohio Mathematics Education Leadership Council. She is a National Board Certified Teacher and winner of the Presidential Award for Excellence in Mathematics Teaching. She has served as a model teacher for the Annenberg/CPB video project and as an Ambassador to ENC. She has recently been named Teacher in Residence for the Governor of the state of Ohio.

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JUMP ONLINE!

Come to the online version of this magazine for details on how this teacher uses geometry software with her fifth graders.
http://www.enc.org/focus/edtech/

TEACHERS CONNECT ONLINE:

Professional Development Through Collaborative Networks

Teachers who use technology for their own professional development quickly find ways to use their learning for the benefit of students in their classrooms.

by Leah Poynter, ENC Publishing

Online technology offers numerous possibilities for teachers to enrich their professional learning. These opportunities often engage teachers in inquiry-based, active learning environments.

Educators exploring online will discover web-based bulletin boards where they can post questions and share ideas. They'll visit real-time chat rooms that foster professional relationships and collaborations. Teachers will find distance learning courses that can be completed for graduate credit from their own homes or schools. Many web-based teacher networks also offer places to share classroom resources, lessons, and project ideas.

Just a few electronic networks are described below. Each offers a unique approach to bringing teachers together.

International NetCourse Teacher Enhancement Coalition Project (INTEC)

http://www.concord.org/intec/

INTEC is an online professional development program that introduces inquiry-based teaching and learning to math and science classrooms. The project supports secondary and middle school teachers in implementing student investigations by offering a set of network-based courses (NetCourses) that link participants with exemplary National Science Foundation (NSF) curriculum development efforts.

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Maine LabNet

http://www.mmsa.org/

Maine LabNet is an online discussion community for the state's K-12 math and science teachers. This teacher-sharing network promotes professional development and supports teacher leadership at the school, district, state, and national levels. It offers contact with teachers experienced in bringing inquiry pedagogy and constructivist teaching to the science and mathematics classroom.

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The Math Forum

http://forum.swarthmore.edu/

The Math Forum is an online community for teachers, students, parents, and all who have an interest in math education. The web site features numerous resources including Ask Dr. Math, a question and answer service for K-12 math students and teachers, and the Teacher2Teacher (T2T) question-and-answer service. The Math Forum also provides ample opportunity to communicate with colleagues through its collection of mailing lists and web-based discussion areas.

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steve@forum.swarthmore.edu

Math Teacher Link

http://MTL.math.uiuc.edu/

Math Teacher Link is a web site designed to deliver professional development opportunities and classroom resources to teachers of mathematics, statistics, and related subjects at the high school and lower college levels. The site includes a Classroom Resource Bank organized by course topics and instructional strategies. An online Message Board allows visitors to communicate while a separate message board is available for participants registered in courses.

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Fax: (217) 333-9576
Email: peressin@uiuc.edu
Email: d-woods2@uiuc.edu

PBS MATHLINE

http://www.pbs.org/mathline

Consisting of the Elementary, Middle, High School, and Algebraic Thinking Math Projects, PBS MATHLINE helps K-12 teachers teach to national standards in mathematics. Included are video lessons, printed lesson guides, and online discussions facilitated by experienced classroom teachers. Additional activities on the web site are updated monthly. Graduate credit courses are also available.

PBS MATHLINE
1320 Braddock Place
Alexandria, VA 22314
(703) 739-5071
Fax: (703) 739-7513
TO ORDER: (800) 344-3337
Email: mathline@pbs.org

TAPPED IN™

http://www.tappedin.org/

TAPPED IN (Teacher Professional Development Institute) is an online community for teachers, professional development providers, and researchers. Visitors can participate in a multi-user virtual environment (MUVE) that enables

Continued on p. 34

JUMP ONLINE

The online version of this article provides more information about and direct links to each of the collaborative networks described. Visit: http://www.enc.org/focus/edtech

Continued from p. 33.

them to hold real-time discussions and classes, send email, post to bulletin boards and listservs, and browse web sites together. Teachers log in to share experiences, find and contribute educational resources, hold meetings, conduct collaborative inquiries, and meet new colleagues.

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The Teachers Network: The TeachNet Project

http://www.teachnet.org/

The Teachers Network is a teacher-to-teacher community that has extended its reach to online networking through The TeachNet Project. The program helps teachers and educational communities create local or regional school improvement projects. Through small grants, the network assists teachers in developing their innovative ideas and connects them with interested colleagues. The web site, called TeachNet.org, provides a number of online resources including classroom activities, teacher-designed projects, a teacher chat room, and a bulletin board service where visitors can post questions and receive replies from colleagues around the world.

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WHY USE CALCULATORS (AND OTHER TECHNOLOGIES) IN THE HIGH SCHOOL MATH CLASSROOM?

Check this article for insights from experienced teachers with a sense of adventure.

By Judy Spicer, ENC Instructional Resources

Mathematics teachers are being bombarded with reasons why it is necessary to change the way mathematics is taught. The National Assessment of Educational Progress (NAEP) shows that "students' knowledge and skills are very fragile and apparently are learned without much depth or conceptual understanding" (Heibert, 1999). For example, although most students learn to perform the arithmetic operations and to work with decimals and fractions by the eighth grade, only 35 percent of eighth graders taking NAEP identified how many pieces were left if 65 pieces of candy were divided equally among 15 bags with each bag having as many as possible.

"The conclusion is that students learn what they have an opportunity to learn: simple calculation procedures, terms, and definitions. They are not learning what they have few opportunities to learn—how to adjust procedures to solve new problems or how to engage in other mathematical processes" (Heibert, 1999).

Can technology really help students become problem solvers?

Teachers Jill Gough, Barbara Schallau, and Tara Windle (see box at right) all believe that graphing calculators and related technologies allow students to tackle problems that cannot be done otherwise. Their classroom experience has also shown them that the use of technology and realistic data serves as a powerful student motivator. With technology, students can visualize mathematical concepts and look for creative solutions to real-world problems. Further, the teachers feel that technology helps them address "the challenge to organize mathematics instruction so that it attracts, and develops the abilities of, the greatest number of students possible" (NCTM, 1992, 13).

One of Windle's favorite classroom activities, Match It, Graph It, starts with algebra I students experimenting with a motion detector. They try to

Group work in Tara Windle's class

Meet three teachers actively engaged in using technology to enhance their students' conceptual knowledge of mathematics

Jill Gough teaches mathematics at the Kiski School, a private school in Pennsylvania, where students use a variety of technologies in all mathematics classes. Gough is interested in trying new ways to help her students increase their conceptual understanding of mathematics.

Barbara Schallau is a mathematics resource teacher in East Side Union High School District located in San Jose, California. A high school mathematics teacher for 10 years, she now is involved with the implementation of STEP 2000, a NSF-funded program to improve success in math and science education for underrepresented students.

Tara Windle teaches mathematics in a suburb of Columbus, Ohio. She taught in the middle school for 17 years until she became intrigued with use of the graphing calculator and requested a transfer to the one high school in her district that uses calculators and related technology extensively in mathematics classes both for college preparatory and vocational programs.

Five Key Questions for Guiding Classroom Calculator Use

1. **Does the calculator allow the students to get closer to mathematical concepts being presented? For example, calculators allow students to explore the nature of exponents and find interesting patterns without engaging in endless, repetitive multiplication.**

2. Will the use of the calculator in a mathematical activity increase student confidence and persistence? Using calculators, some students will function successfully with statistical concepts and data despite previous negative mathematical experiences.

3. Could the concept be taught with an inductive approach? One of the crucial steps in operations with decimals (even in estimation) is placing the decimal point correctly in the sum, difference, product, or quotient. Procedures for correct placement can be explored and developed using the calculator.

4. Would the use of the calculator facilitate the study of real-life applications? Quantitative problem solving involving real-life issues with real-world numbers can successfully be pursued using a calculator.

5. Will the calculator allow assessment to be focused on relevant educational objectives? Teachers can measure conceptual understanding and problem solving when computational errors are minimized by calculator use.

NCTM, (1992).

match their walking motion to reproduce a piecewise function of time and distance displayed on the calculator screen. Windle feels it is very difficult for students to relate a graph to real-time activity. She observes that this lesson helps students begin to develop a conceptual understanding of what a graph represents, the meaning of slope of a line, and how functions can be used to describe a relationship. (For an in-depth discussion of this activity, including an illustration and reference, see the article on page 37.)

Gough uses the Internet as a data source because she believes that students process best what is real to them. Track and field world records from a web site in Finland http://www.saunalahti.fi/~sut/eng/index.html, weather data http://www.weather.com/twc/homepage.twc, and airline flight information http://usairways.com/ are just a few examples of the sort of Internet data that Gough uses to engage her students in mathematics.

Gough realized the impact of technology and the importance of using real-world examples when she received a note from a former student. The student wrote that he had enjoyed math for the first time in her class, taken during his junior year, because he got to use mathematics to analyze National Basketball Association statistics, something that really was of interest to him.

Both teachers can not imagine teaching geometry without using a software package. According to Windle, "Technology makes teaching geometry a thousand times more fun. It is amazing how much you can accomplish drawing and experimenting with a geometry software package. The exploration options are endless."

Can technology benefit all students?

The aim of education is to take all students from where they are and help them learn. Gough, Schallau, and Windle have found that technology can help some students who struggle with computation move on to mathematical concepts and applications. The use of graphing calculators, probes, and computers helps teachers address mathematical topics using a variety of learning styles. These tools reach out to more students than are usually successfully addressed in the chalk-and-talk math class.

Gough describes a class project for modeling with trigonometry functions that involved collecting and analyzing data on sunrise and sunset times in three different latitudes http://www.mtbinfo.com/misc/Sunset.shtml. This lesson produced a wonderful moment when one of her least successful students developed an understanding of the patterns found in the data.

Schallau describes a similar situation that occurred when she visited the middle school and had the opportunity to introduce graphing calculators to eighth graders. "Several students who normally don't do much work (according to their teachers afterwards) thrived with the technology. One boy in particular has a slow processing ability. It takes him too long to get his paper out, write the problem, and solve it. With the technology, he was able to complete the examples quickly and get feedback (the graph) right away. His teacher was totally amazed at how much he participated and that he completed most of his homework assignment before leaving class!"

In addition to helping students who struggle, technology entices those who excel. Schallau was instrumental in arranging for the use of Title I funds to acquire graphing calculators for use in algebra I classes. She emphasizes, "The use of graphing calculators as early as eighth grade offers students opportunities for exploration and visualization that create a strong conceptual foundation for mathematics. With this understanding, students tend to view mathematics as a worthwhile subject to study."

JUMP ONLINE!

The online version of this article includes a list of online resources and direct links to them. Visit: http://www.enc.org/focus/edtech/

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How do I start using technology?

Gough suggests, "Start with what you have, use it, and then ask for more! Take out that classroom set of graphing calculators or the computer on a cart and see what it has to offer students. Think about where this technology could enrich your subject matter. Usually that means helping students understand concepts via visualization or exploration."

Windle urges others not to be afraid of making a mistake or not knowing all the answers; the first time using new material or technology is always the hardest.

Schallau agrees. "My students' first day with the graphing calculator was also my first day. I started learning with them and continue to learn with them 10 years later." (See box on this page for her suggestions on introducing graphing calculators to students.)

All three teachers suggest finding a fellow teacher to work with and investing some time, that most precious commodity, in your growth as a teacher.

Even if you are not the teacher who thinks calculators and computers are the best thing for math class since the invention of the chalkboard, be willing to try them. Go to the online version of this magazine (see p. 35) and link to just a few of hundreds of sources of information about technology in the classroom. You will be on your way to becoming a teacher who truly prepares students for the 21st century! ●

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Introducing Graphing Calculators

When introducing graphing calculators to students, Barbara Schallau recommends, "Start with one day of exploration. I have students work in pairs, with manuals or without, to explore the calculator and its features. Each pair of students is to present one new feature or discovery. I have an overhead calculator up at all times since students often want to just jump up and share a 'really cool' discovery."

After this introduction, she makes the calculators available to students at any time during the class. "Students will become more comfortable using the technology after they spend more time with it, even if they use it just for regular computations. Later, to move them to a higher level of understanding, I introduce an activity where students discover the effects of changing the slope of an equation. This is an easy but powerful assignment."

Jill Gough and students

USING TECHNOLOGY TO HELP CHILDREN FORM REPRESENTATIONS OF MATHEMATICAL CONCEPTS

Are you wondering why NCTM is introducing the new category, Representation, in Standards 2000? This teacher educator explains the fundamental nature of representation and describes how technology can be used to support the development of mathematical understanding in students.

by Stephen J. Pape, The Ohio State University

Learning mathematical ideas is a difficult task for students. Teachers often struggle to find ways to help their students understand very abstract notions. In addition, there is a call for the teaching of algebra in middle school and algebraic concepts even earlier. As we face this challenge, we must think about how best to help children form understandings of mathematical abstractions.

In contemporary educational theory, this challenge translates into a quest to help children construct internal representations of the abstract concepts embodied in external representations. Now, what implications does this have for the classroom teacher?

Internal representations are cognitive abstractions of mathematical concepts that are developed through experience. External representations, such as graphs, tables, diagrams, and charts, serve as images of these mathematical concepts and may be regarded as "embodiments of ideas or concepts" to be learned (Janvier, Girardon, & Morand, 1993, p. 81). It is the job of the teacher to help students internalize concepts presented in mathematical symbols or in graphs and other external representations of these concepts.

Representing the Concept of Slope

Let's examine the concept of slope as an example. In a distance-time graph, the steepness of the line is an indication of, or represents, how quickly the distance is changing within a given time period. Thus, the teacher must grapple with how to help students understand the concept of slope as a rate of change of one quantity, distance, in relation to another, time. That is, the teacher must help students form an accurate internal representation of an abstract mathematical concept embodied in the graph.

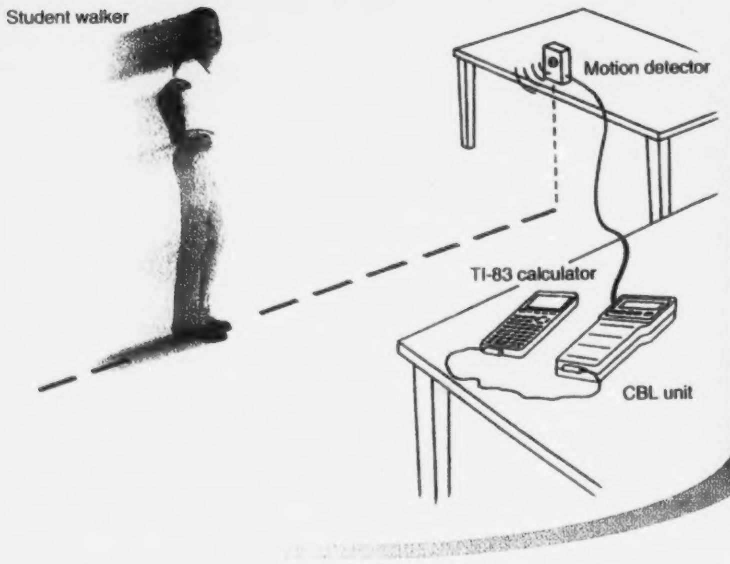
Representations have been classified in many ways. Bruner (1966, as cited in Janvier, Girardon, & Morand, 1993) developed one important approach. In this scheme, representations are categorized as enactive, iconic, or symbolic. Enactive representations refer to the activity basis of a concept (e.g., the motion of an object). Iconic representations refer to the images that embody the concept (e.g., the graph of this motion), and symbolic representations refer to the characters that mathematicians have agreed upon to represent the mathematical concept (e.g., the "m" that represents the concept of slope or the equation used to determine the slope of a line). This distinction is an important one because each represents a different level of abstraction that we ask students, often young students, to move through in their quest for understanding.

Bruner's classification also points toward a sequence of learning experiences that might help young learners come to an understanding of abstract concepts. First, we might have the students move their bodies in accordance with the image of motion on a graph. Then, slowly, we might begin to translate this motion and graphical image into symbolic representations. According to Lesh's model of translations between modes of representations (Behr, Harel, Post, & Lesh, 1992), to truly understand a mathematical concept, students must have experiences translating among different representations of the same mathematical concept (i.e., the motion, the graph, and the symbolic representations).

Finally, these translations must take place within a social environment. While communicating the meaning of graphical representations, students come to negotiate meanings of standard representational forms (DiSessa, Hammer, Sherin, & Kolpakowski, 1991; Greeno & Hall, 1997). For example, one student could interpret a graph by orally directing the movement of another student to represent enactively the motion of the graph.

Using Technology to Enhance Experience

What experiences might help students form an accurate representation of abstract concepts such as speed or acceleration? To understand such a concept, students need to experience what it means to represent an object, perhaps themselves, moving faster or slower. In working through the enactive representation of this concept (i.e., actually moving faster or slower), the student forms



a notion of slope that may then serve as the basis for an internal representation of this abstract idea.

How might we provide this experience? One suggestion is through the use of technology. Texas Instruments' (TI) activity guide, *Real-World Math with the Calculator-Based Laboratory (CBL) System: 25 Activities Using the CBL and TI-82* (Brueningsen, Bower, Antinone, & Brueningsen, 1999), provides an activity that might help students form an understanding of the concept of slope.

In the activity Match It, Graph It (also mentioned on p. 34), students are asked to "walk the graph" indicated by the program. Various graphs are provided that represent different types of motion, and the students are asked to move in such a way that they trace the graph through their movement. As an individual student walks, a motion detector produces a graphical tracing of that motion on the calculator screen. The student may attempt to re-walk the graph until his or her tracing of the graph more accurately represents the original graph of the motion. Even adults have difficulty at first tracing the graph with their movement. Thus, it is important that students be given a number of attempts to trace the motion depicted on the screen until their speed accurately depicts the slope of the distance-time graph on the calculator screen.

After multiple attempts to model the motion depicted on the graph, the students may come to an understanding that the steepness of the graph—the slope of the line—is indicative of the rapidity of the change in distance relative to the change in time. This activity facilitates the construction of an internal representation of the concept of slope that may serve as the basis for learning the symbolic representation. Finally, through the use of the trace function on the calculator, the activity brings the students toward an understanding of the symbolic representation of slope by guiding the students' calculations of the slope for various portions of the graph they created.

This activity provides the translations between enactive, iconic, and symbolic representations that are necessary for learning the abstract concept of slope. However, beyond providing a technology-based activity, it is important to consider how this example might be used by the classroom teacher. It is not enough for the students to simply replicate the graph as presented. These translations must occur within a social environment where individuals communicate the relation of the graph to the motion of another individual. This communication allows the participants to practice interpreting the graphs as they are presented.

In summary, representations, such as distance-time graphs, can be thought of as tools for thinking and behaving rather than end products. They lighten the cognitive load and serve to organize each student's understanding of a concept as the external representation embodies the concept to be learned. ◉

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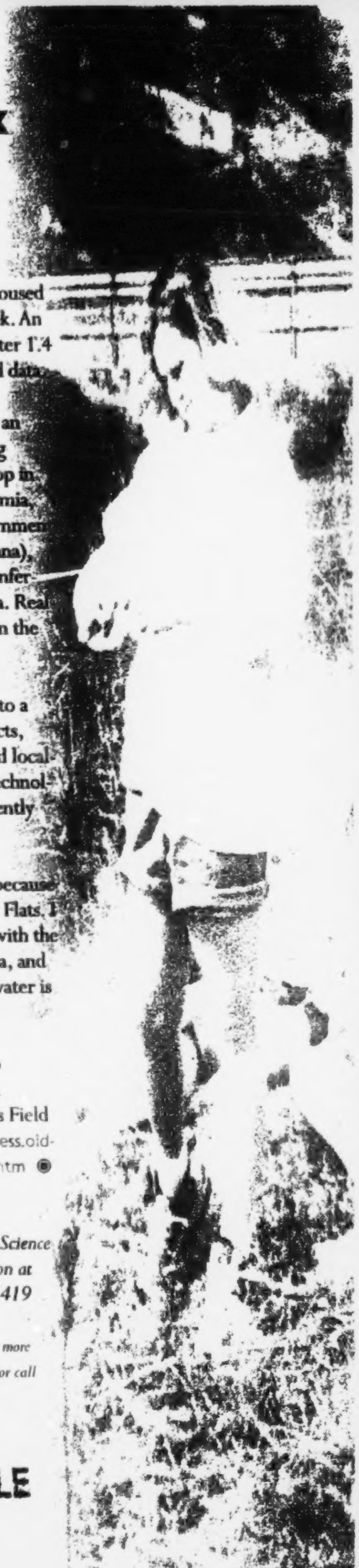
STUDENTS GO WIRELESS TO SAVE CREEK

A Montana middle school science class helps to clean up a polluted creek using computer interfacing and wireless technology

by Steve Paulson, Science Teacher, Lewiston, Montana



Deep in the heart of Montana's Big Sky Country, Lewistown's Big Spring Creek flows from what once was called the purest water source on the continent. Unfortunately, after decades of railroad misuse, pollutants consumed Big Spring Creek and turned the surrounding area into an algae-infested swamp. Today, an agricultural community of 6,000 flourishes where the rail yard used to be; its inhabitants are dedicated to returning the creek to its former glory.

A number of public and private contributors in our community are helping to clean up Big Spring Creek, and the eighth grade students in my life science classes have been doing their part since 1995. They regularly trek down to the creek to collect data and analyze its characteristics using remote interfaces and sensors. I don't use textbooks. We have eight computers and the students learn faster working at their own pace.

Last year my class and I teamed up with the National Science Foundation's (NSF) Wireless Field Tests for Education project. Located more than 100 miles from the nearest Internet service provider, Lewistown Junior High aptly served the NSF project goal. NSF is field-testing a variety of wireless devices that can be integrated inexpensively into telecommunications networks (such as the Internet) to serve the broadest interests of public education and research. David Hughes, NSF co-chair of the project, set up a research grant to provide us with the scientific and communications equipment necessary to enable remote monitoring and ultimately contribute to restoration of Big Spring Creek.

Although monitoring the creek via the computer was fairly easy and straightforward, wireless transmission of data over the Internet requires some explanation. The wireless device acts like a long serial cable, essentially connecting the classroom to the interface at a site miles away.

In this case, data are collected through seven sensors (temperature, light, flow rate, dissolved oxygen, pH, conductivity, and nitrate ion-selective) connected by 15-foot wires to two ScienceWorkshop® 500 interfaces, each powered by one 12-Volt battery. The whole setup is housed with a 1-watt radio in a box next to the creek. An antenna connected to our classroom computer 1.4 miles from the creek then picks up collected data.

The students saved the data and posted it to an Internet server. Meanwhile, at the Emerging Remote Wireless Communications Workshop in Washington, DC, 200 attendees from academia, the communications industry, and the government (including Senator Max Baucus from Montana), monitored the students' actions via a teleconference link between Washington and Montana. Real time creek data was displayed at their site on the students' web page.

After this experience, I can envision access to a World Wide Web of different science projects, experiments, and data that can be generated locally and published globally. Use of wireless technology can bring Internet access to users currently restricted by geographic location or cost.

Our class was not at the creek last spring, because of the creek restoration project at Brewery Flats. I have one student, John Schmidt, working with the wireless now, collecting environmental data, and we will be back on the stream before the water is put in the new channel this fall.

To see the web site, direct your browser to http://www.lewistown.net/~library/Trailhead. For more information on the NSF Wireless Field Tests for Education project, see http://wireless.oldcolo.com/ or http://192.160.122.20/report18.htm ◉

For additional information about the National Science Foundation wireless project, contact Steve Paulson at spaulson@lewistown.net *or call (406) 538-5419*

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Focus on the Collection:

Choosing Educational Technology to Promote Learning Excitement

by Terese Herrera, ENC Instructional Resources

Technology has become a true force in education. Even where its direct impact is still only minimal, teachers are aware of the questions posed by its presence and its potential. The question we hear most often from mathematics and science teachers is "How can technology best be used in teaching the actual day-to-day curriculum?" It was this question that guided us as we made this list of resources, which is divided into two primary categories: Professional Development and Classroom Resources.

Professional Development

Background Knowledge
Before determining how to apply technology in the classroom, practitioners need background information on the mechanics involved—the operational "how-tos." Some of this information can be found in Gay Gordon's article "Help! I Just Got My First Computer" on page 20, and additional resources are listed in this portion of the Collection Section. Here you will find materials that address needs such as setting up your email, managing the one-computer classroom, and writing acceptable-use policies for the school.

Instructional Issues
Also in this section are resources that address issues teachers consider every day as they make curriculum choices. When educational technology is factored into the equation, those issues take on a distinctive and challenging slant. We have selected resources that provide ideas on gender equity in managing the computer classroom and choosing software, on appropriate calculator use, and on the role of technology within the larger framework of education reform. Included are teachers' personal narratives of how their roles changed (see *Students as Experts*, ENC-013899) and how they fared on the Internet (see ENC-004271, *Tales from the Electronic Frontier*).

Web-Based Professional Development
Clearly, the Internet has the potential to become a powerful tool for teachers' professional growth, especially for those who teach in rural areas or who for other reasons find it difficult to obtain technical assistance. Because of this potential, we have selected a number of web sites—only a sampling of those that are available—that provide opportunities for teacher-to-teacher communication, free

newsletters, online courses, and sources of in-depth treatment of math and science content. One example, Exploring Data (ENC-011678), created and maintained by a high school science teacher, provides background on statistics, a relatively new topic in the high school curriculum. This site defines and gives examples of statistical measurements, discusses their use and misuse, and provides collections of real data that students should find interesting. Another site, ENC's Teacher Change: Improving K-12 Mathematics (ENC-014838), offers workshop activities, teachers' narratives, and the full text of journal articles and TIMSS information.

Integrating Technology

Most materials in this section deal directly with using technology as a teaching tool. This is the core issue for classroom teachers. Our own philosophy agrees with Dockterman's advice in his book *Great Teaching in the One-Computer Classroom* (ENC-013824): "Start with your educational goals and let the technology serve them" (p. 2). Calculators and computers are tools; through a teacher's direction they can be used to build unique learning environments. The resources in this section describe some of these environments, as well as ways to create them.

Curriculum Resources

Math and Science Lessons

In this section you will find actual examples of lessons that incorporate technology into the math/science curriculum. For example, Lessons Developed by Susan Boone (ENC-00406) is a web site that offers problem-solving algebra lessons that use the Internet as a source for information gathering. Another example is *Data Collection Activities for the Middle Grades* (ENC-013896), an activity book that integrates mathematics and the sciences through investigations that use calculators and probes to collect data.

In regard to calculators, rather than listing all the models available, we concentrated primarily on resources that provide ideas on incorporating the hand-held technology into math and science teaching. As an example, *Data Collection Activities for the Middle Grades with the TI-73, CBL and CBR* (ENC-013896) contains a set of activities that integrate mathematics and the sciences through investigations that use calculators and probes to collect data. Each investigation includes teacher notes, student activity pages that describe the context, and data analysis sheets. In this instance, the CBR (Calculator-Based Ranger, ENC-013862) itself is then described, because of its additional features and its newness in the field.

Online projects provide classroom experiences not accessible without the Internet. Welcome to the Monarch Watch! (ENC-002473), for instance, engages students in collecting and submitting data in a national collaborative effort to monitor the migration of the Monarch butterfly. Other projects make use of the Internet to find information needed to solve a real-world problem, such as determining the location and speed of a ship that carries a stowaway student. We also included examples of virtual field trips, which take the class from site to site in a planned investigation of a chosen topic. In selecting these activities, we chose examples that both further the math and science curriculum and make use of technology to enhance it.

Along with the resources in the first part of this section, we included tools such as microscopes and "virtual manipulatives"—web sites that allow students to interact with the content. At one site, students manipulate onscreen images by using the mouse to open an angle as they watch a degree counter move from 0 through 180 degrees. Similarly, in an introduction to the Pythagorean Theorem, visitors can construct a series of right-angled triangles and measure the sides.

Of course, teachers have been using these ideas in their instruction for a long time; what technology adds is the opportunity to generate within the class period sufficient examples for students to analyze. For example, the web site The Virtual Cell (ENC-014670) allows students to view three-dimensional color drawings of the cell and the organelles. Clicking on an organelle in the cell brings up textual information next to an enlarged drawing of it. With many of the organelles, students can cut through or dismantle the outer membranes to reveal the interior structures. Visitors can also rotate the image left or right and zoom in and out with navigation buttons.

Math and Science Software and CD-ROMs

Finally, we selected a variety of math and science software materials for kindergarten to high school. We selected programs that further the school curriculum, whether through a game format (*Green Globs* ENC-013633) or a problem-solving scenario (*Investigating Lake Iluka* ENC-014194). Others are more properly termed "tools," such as *The Graph Club with Fizz and Martina* (ENC-014421), which allows students to make graphs using their own data or to explore graphs generated by the program.

Space Is Limited

As always, we must emphasize that this list of exemplary resources is certainly not comprehensive. The materials featured in this issue were selected from the existing collection at ENC. Furthermore, due to limitations of space, we limited our search to computer, Internet, and calculator resources. Many innovative products in educational technology are being developed at an incredible rate and we continue to add materials to our repository, so be sure to check our online catalog for resources not highlighted in this issue. And please let us know of other materials that you would recommend via email at submit@enc.org.

We hope this sample of what's out there in educational technology encourages you to explore new vehicles of instruction. In considering how you would integrate technology into your own classroom:

> The key is that you embrace it and make it yours. The technology should excite you and your students; it should enhance the relationships you build with each other; it should help you expand and improve what you do in the classroom. When the technology plays those roles, it will truly be a powerful tool for education. (Dockterman, p. 91) ●

Dockterman, David A. 1998. *Great Teaching in the One-Computer Classroom.* Watertown, MA: Tom Snyder Productions.

The very easiest way to access all the web sites mentioned in this magazine is to visit the online version:

http://www.enc.org/focus/edtech/

SEARCHING

ENC's Collection of Curriculum Resources

You can get to Resource Finder, ENC's online database of educational materials, at http://www.enc.org/. Four search engines are available to search ENC's collection of math and science resources: the Simple Search and three advanced search options (No Frames Enhanced, Enhanced Search, and Browse/Search). A site search is available that searches the entire ENC Online web site.

Simple Search allows you to search using words as well as grade level and cost. A sample Simple Search could include Hands-on AND Butterflies as Search Words, Grade 2, and any cost. The return list includes resources with both "hands-on"and "butterflies" in the catalog records.

The No Frames Enhanced search allows you to better limit and define your search. In addition to word search, grade level, and cost, limiters such as Resource Type, Subject, and Standards are available. Lists of ENC's controlled vocabulary are provided. For instance, Resource Type includes words such as Math Curriculum Programs, Professional Guides, Teacher Guides, and World Wide Web (WWW) resource. A sample search using No Frames Enhanced could have data analysis (if you use more than one subject, the terms needs to be separated by a comma) as Subject; 9-12 as Grade; and World Wide Web site as Resource Type. One of the resources in the return list is Exploring Data (ENC-011678). The Enhanced Search, which uses frames, features pop-up vocabulary lists. The Browse/Search feature allows you to browse large categories based on ENC's subject lists.

You can also search by ENC number, a designation we assign to each resource to indicate where it is shelved in our repository. The number can be found in the upper left of the catalog record on your computer, or at the end of the abstract in *Focus.* You can search for specific records in Resource Finder by typing in the ENC number in the search words blank. For example, typing in ENC-013959 brings up the record for *Integrating Technology into the Science Curriculum* (1998), published by Teacher Created Materials, Inc. When contacting ENC about a particular resource, be sure to refer to the ENC number.

For each item in a return list, an icon lets you know what kind of resource it is (for example, video, kit, or web site). Each icon is followed by descriptive text that contains its title, grade range, cost range, and the beginning of the abstract. Clicking on the title brings up the entire record, including the complete abstract, the table of contents, any evaluations, and availability information.

Soon you will see many changes to ENC Online and Resource Finder. Some of the particular strategies for searching Resource Finder will change and these instructions will be out of date. Visit ENC Online to learn about the best ways to use our improved resources. ●

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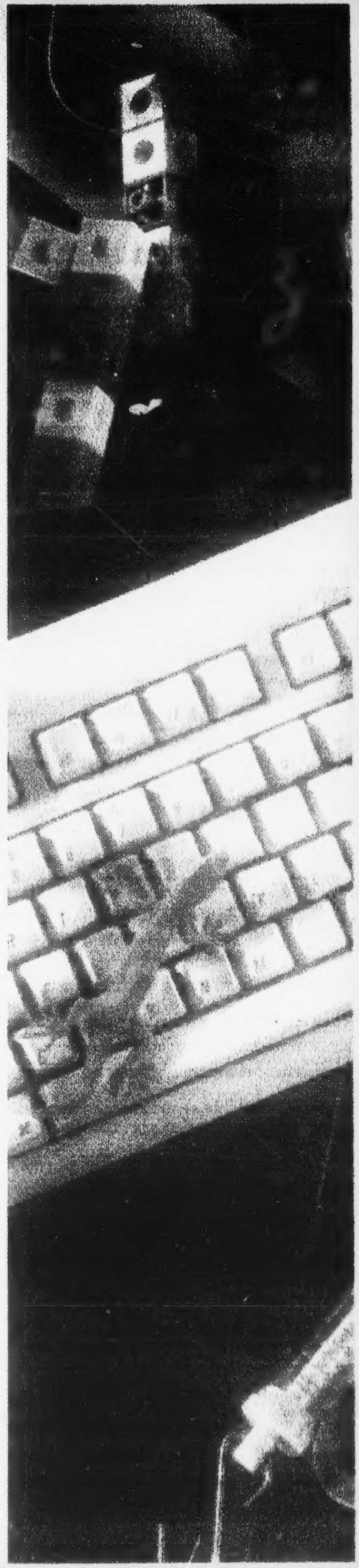


Please note that this section is based on abstracts found in Resource Finder, ENC's database of K-12 materials. All ENC abstracts are descriptions rather than evaluative reviews. If you search Resource Finder through ENC Online http://www.enc.org/ you will find complete records for these selections. Some records provide links to online, third-party reviews and/or references to journal reviews. Pricing and ordering information was verified in June, 1999, and is subject to change.

background knowledge

Internet Issues Bookshelf Series

Creating Acceptable Use Policies

Grades K-12
1998
Author: editor, Dorissa Bolinski; writers, Dorissa Bolinski, Christopher Mautner, Timothy McLain

Ordering Information:
Classroom Connect Inc.
431 Madrid Avenue
Torrance, CA 90501
Telephone: (310) 618-0109
Fax: (888) 801-8299
Toll-free: (800) 638-1639
connect@classroom.com
http://www.classroom.com/

$24.95 per book (paperback)
Order # ADM-2010-C182

Written for educators and parents, this book contains guidelines for creating acceptable use policies (AUPs) that deal with the issues and controversies surrounding Internet access for schools. The book begins with a discussion of guidelines for defining the goals of an AUP, student responsibilities, and penalties for misuse of Internet access. The next chapter presents the opinions and experiences of educators who have either been directly involved in writing their school's AUP or have witnessed its effects in their schools. Subsequent chapters guide readers through the process of researching, planning, and outlining an AUP; describe the major elements of an AUP; and provide sample wording for each element. Additional topics include blocking software, Internet training for parents and students, and updating existing AUPs. Three sample AUP documents are included in the appendix. (Author/LCT) ENC-013850

TechKNOWLEDGEy Series

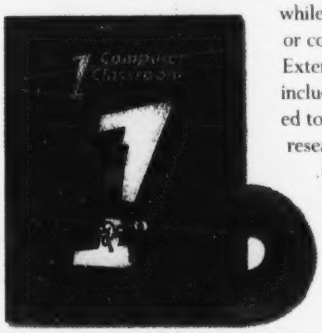
Managing Technology in the 1 Computer Classroom or 2 or 3

Grades 1-8
1999
Author: Susan L. Gimotty; illustrator, Bruce Hedges

Ordering Information:
Teacher Created Materials, Inc.
6421 Industry Way
Westminster, CA 92683
Fax: (800) 525-1254
Toll-free: (800) 662-4321
http://www.teachercreated.com/

$19.95 per CD-ROM (Macintosh/Windows)
Order # TCM 2457
Note: Contact publisher for system requirements.

The TechKNOWLEDGEy Series of resource books and CD-ROMs is designed to help teachers use technology to increase their productivity, enhance student learning, and reinforce their curriculum. The CD-ROM contains examples and templates for the projects in the book. The first section of the book discusses connectivity and classroom management with one computer. It also highlights ways to use the computer to make portfolios, newsletters, and memos; to compute grades; and to make presentations for lessons or back-to-school nights. The second section offers lesson plans, templates, and Internet sites to help the teacher get started integrating technology into the current classroom curriculum. Each lesson plan states the lesson objective, recommends a relevant Internet address, and provides detailed instructions for using the computer to find information. In a sample lesson, How Far Is It?, students reinforce their basic map skills while finding distances between cities or countries with the computer. Extension ideas for this lesson include creating math problems related to distance, planning a trip and researching lodging and area attractions, and locating cities on a map of the United States and labeling traveling distances. The last part of the book discusses examples of skill building and simulation software suitable to the one computer classroom. Software for all curriculum areas is highlighted. The book includes a glossary of computer terms and bibliographic references. (Author/JRS) ENC-013650



Exploring the Internet Series

Exploring the Internet

Grades 3-6
1997
Author: Nebraska Interactive Media Group

Ordering Information:
Great Plains National (GPN)
PO Box 80669
Lincoln, NE 68501-0669
Telephone: (402) 472-2007
Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn@unl.edu
http://gpn.unl.edu/

$319.00 per series (10 programs/teacher's guide)
$34.95 per video with teacher's guide

The first video in the 10-part Exploring the Internet series introduces a variety of Internet applications to students in grades 3-6. The series provides a basic understanding of how the Internet works. This video seeks to cultivate student interest in Internet exploration by highlighting some Internet capabilities. It depicts students and their teacher using the Net to follow modern-day explorers who are traveling along the Oregon Trail and detailing their adventures on the Internet. Viewers also learn how a fifth grade class gathered and organized weather data from around the world using online sources. In a third scenario, a second grade class cooperatively published a book with a class in Japan. The teacher's guide for the series includes lesson descriptions, pre- and post-viewing activities, a glossary and suggested vocabulary, and resource lists. (Author/JRS) ENC-013929

Exploring the Internet Series

Web

Grades 3-6
1997
Author: Nebraska Interactive Media Group

Ordering Information:
Great Plains National (GPN)
PO Box 80669
Lincoln, NE 68501-0669
Telephone: (402) 472-2007
Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn@unl.edu
http://gpn.unl.edu/

$319.00 per series (10 programs/teacher's guide)
$34.95 per video with teacher's guide

Part of the Exploring the Internet series described on the previous page, this video introduces students to the types of materials that can be found on the web and how they are accessed, emphasizing the Internet's usefulness as a source of information. In the video, students learn about web browsers, web sites, Universal Resource Locators (URLs), and the use of Hypertext Markup Language (HTML). Included are ideas for creating and posting a school homepage or class web page. Viewers also learn about copyright concerns and privacy issues. (Author/JRS) ENC-013934

Exploring the Internet Series

Web for Teachers

Grades 3-6
1997
Author: Nebraska Interactive Media Group

Ordering Information:
Great Plains National (GPN)
PO Box 80669
Lincoln, NE 68501-0669
Telephone: (402) 472-2007
Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn@unl.edu
http://gpn.unl.edu/

$319.00 per series (10 programs/teacher's guide)
$34.95 per video with teacher's guide

Part of the Exploring the Internet series described on the previous page, this video explains and demonstrates the four steps students should follow as they use the Internet to do research for a report: choosing a topic and identifying research questions; finding and collecting information; organizing and presenting information; and participating in teacher-, self-, and peer-evaluation. The two student hosts for this video illustrate the process by explaining how one of them learned about training horses and the other researched falling stars. This video looks at the value of and possibilities for multimedia reports, as well as issues of plagiarism. (Author/JRS) ENC-013936

Exploring the Internet Series

Doing Research for Teachers

Grades 3-6
1997
Author: Nebraska Interactive Media Group

Ordering Information:
Great Plains National (GPN)
PO Box 80669
Lincoln, NE 68501-0669
Telephone: (402) 472-2007
Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn@unl.edu
http://gpn.unl.edu/

$319.00 per series (10 programs/teacher's guide)
$34.95 per video with teacher's guide

Part of the Exploring the Internet series described on the previous page, this video discusses the educational models that are the basis for a step-by-step approach to doing research on the Internet. This four-step approach is intended to encourage students' critical thinking and analysis. As with the preceding video, this program explains and demonstrates the four steps students should follow when doing Internet research. Specifically for teachers, the video also discusses the creation of rubrics for evaluating the research projects. (Author/JRS) ENC-013937

Exploring the Internet Series

Email

Grades 3-6
1997
Author: Nebraska Interactive Media Group

Ordering Information:
Great Plains National (GPN)
PO Box 80669
Lincoln, NE 68501-0669
Telephone: (402) 472-2007
Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn@unl.edu
http://gpn.unl.edu/

$319.00 per series (10 programs/teacher's guide)
$34.95 per video with teacher's guide

Part of the Exploring the Internet series described on the previous page, this video introduces electronic mail (email) by describing its similarities to and differences from regular mail. In the program, students and their teacher use email to correspond with pen pals, participate in an Ask A Scientist Program, and join Internet clubs for kids. The video shows actual email screens and describes what is found in an email address. Viewers also learn about privacy issues with email and about problems with incorrect addresses. (Author/JRS) ENC-013930

Exploring the Internet Series

Email for Teachers

Grades 3-6
1997
Author: Nebraska Interactive Media Group

Ordering Information:
Great Plains National (GPN)
PO Box 80669
Lincoln, NE 68501-0669
Telephone: (402) 472-2007
Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn@unl.edu
http://gpn.unl.edu/

$319.00 per series (10 programs/teacher's guide)
$34.95 per video with teacher's guide

Part of the Exploring the Internet series described on page 45, this video introduces teachers to some of the possibilities that electronic mail (email) presents for professional development and learning, highlighting its usefulness in communicating with other teachers, classes, and experts from around the world. In the video, teachers learn about joining listservs for professional development and using the Internet to break down professional isolation. Included are ideas for creating interdisciplinary classroom projects such as corresponding with a scientist in Antarctica or forming a group of classes that cooperatively write a chapter story. Viewers also learn about using email as a time saver, privacy issues with email, etiquette on the Internet, and the importance of previewing classroom mail. (Author/JRS) ENC-013932

Exploring the Internet Series

Integrating Technology into the Classroom

Grades 3-6
1997
Author: Nebraska Interactive Media Group

Ordering Information:
Great Plains National (GPN)
PO Box 80669
Lincoln, NE 68501-0669
Telephone: (402) 472-2007
Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn@unl.edu
http://gpn.unl.edu/

$319.00 per series (10 programs/teacher's guide)
$34.95 per video with teacher's guide

Part of the Exploring the Internet series described on page 45, this video demonstrates how teachers, library media specialists, and educational technology experts can work together to integrate the Internet into the classroom. The tape explores the types of learning activities that are best suited to the technology and explains how Internet use builds cooperative learning skills. Also offered are tips on how to incorporate use of the Internet into existing lesson plans. Teachers are encouraged to work in teams to develop Internet-enhanced lessons and to preview all Internet connections before presenting them to students. (Author/JRS) ENC-013938

Exploring the Internet Series

Net Surfing for Teachers

Grades 3-6
1997
Author: Nebraska Interactive Media Group

Ordering Information:
Great Plains National (GPN)
PO Box 80669
Lincoln, NE 68501-0669
Telephone: (402) 472-2007
Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn@unl.edu
http://gpn.unl.edu/

$319.00 per series (10 programs/teacher's guide)
$34.95 per video with teacher's guide

Part of the Exploring the Internet series described on page 45, this video introduces teachers to searching the Internet, or Net surfing, for curriculum and professional development information. It also includes ideas about using the Internet for classroom motivation and explains how to download information and software from the web. Teachers also learn what a computer virus is and how to use virus checking procedures. Viewers hear from students about how easy they find using the Internet to be, and they learn how research on the Internet can promote students' interest in library research. (Author/JRS) ENC-013933

Exploring the Internet Series

Net Surfing for Kids

Grades 3-6
1997
Author: Nebraska Interactive Media Group

Ordering Information:
Great Plains National (GPN)
PO Box 80669
Lincoln, NE 68501-0669
Telephone: (402) 472-2007
Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn@unl.edu
http://gpn.unl.edu/

$319.00 per series (10 programs/teacher's guide)
$34.95 per video with teacher's guide

Part of the Exploring the Internet series described on page 45, this video teaches students to search Internet databases to gather information, find pictures, and collect sounds. The program describes how to read books from foreign libraries, find weather forecasts for different locales, and watch astronauts work in space. In the video, students and their teacher use the Internet to create reports that are saved on computer disks and that include sounds and pictures obtained from Internet databases. Viewers also learn about software and games available on the Internet. (Author/JRS) ENC-013931

Making the Link: Teacher Professional Development on the Internet

Grades K-12
1996
Author: Ron Owston

Ordering Information:
Greenwood Publishing/ Heinemann Educational Books Inc
88 Post Road West
PO Box 5007
Westport, CT 06881
Telephone: (603) 431-7894
Fax: (800) 847-0938
Toll-free: (800) 225-5800
custserv@heinemann.com
http://www.heinemann.com/

$24.00 per book (paperback)

Inservice teachers, school administrators, and professional development coordinators can read this book to learn ways of using the Internet as the primary vehicle for professional development. The author explains the basic function of web browsers, email, and search tools. He then goes on to show how to use those tools to create a professional development action plan based on building virtual professional communities and conducting Internet-based research. Readers learn how to use mailing lists and newsgroups to share ideas with colleagues around the world. The book uses first-hand accounts by users of this approach to give a sense of what to expect from a newsgroup or other online services. Also provided is information on how to access helpful web sites related to professional development. (Author/RMK) ENC-012911

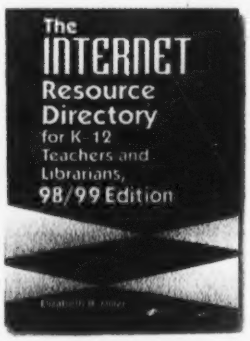
The Internet Resource Directory for K-12 Teachers and Librarians

Grades K-12
1998
Author: Elizabeth B. Miller

Ordering Information:
Teacher Ideas Press/
Libraries Unlimited
PO Box 6633
Englewood, CO 80155-6633
Telephone: (303) 770-1220
Fax: (303) 220-8843
Toll-free: (800) 237-6124
http://www.lu.com/tip/

$25.00 per book (paperback)

This reference book is an annotated bibliography of over 1,400 Internet sites. The fifth in a series of annual publications, this edition features online resources for state and national standards for science, mathematics, and language education. Expanded chapters include early childhood and special education resources, and an accompanying web page provides free, monthly updates to the directory. The directory is divided into 11 chapters, each addressing a different area of the K-12 curriculum. Two chapters, Resources for Educators and The School Library, contain professional information as well as lesson plans and general information specific to education, schools, and the school library media center. A reference chapter focuses on resources that can be used across the curriculum. Each resource was selected according to criteria that evaluated it based on its support for the school curriculum, its current content with regular updates, and its promotion of collaborative, life-long learning. (Author/LCT) ENC-014285



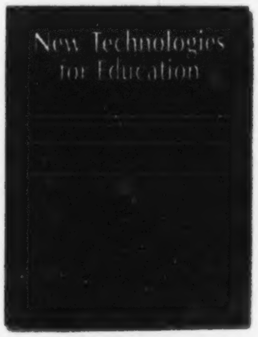
New Technologies for Education: A Beginner's Guide

Grade K and up
1997
Author: Ann E. Barron, Gary W. Orwig

Ordering Information:
Teacher Ideas Press/
Libraries Unlimited
PO Box 6633
Englewood, CO 80155-6633
Telephone: (303) 770-1220
Fax: (303) 220-8843
Toll-free: (800) 237-6124
http://www.lu.com/tip/

$32.50 per book

This overview of the advantages and disadvantages of high-tech tools is designed for educators who are interested in bridging the technology gap and finding instructional applications of technology. Topics include CD-ROMs, videodiscs, presentation programs, and telecommunications. Each chapter contains a scenario to illustrate implementation techniques, a copy-ready brochure for inservice training workshops, and resource information. For example, one chapter begins with a scenario about students who are working on a multimedia critique of the negative campaign strategies used in the presidential primaries. The scenario illustrates issues of multimedia editing, copyright problems, and integration of videotape, digital still images, and digitized audio recordings. The chapter then explains the differences between analog and digital and discusses digital cameras, image compression, and digital versatile discs (DVD). A glossary of related terms, list of resources, and additional references on the topic are included in the chapter. (Author/JSR) ENC-014365



101 Essential Tips Series

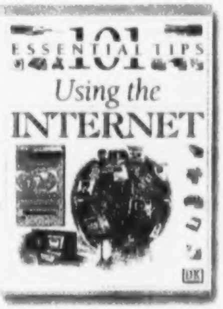
Using the Internet

Grade Pre-K and up
1997
Author: technical consultant, Chris Lewis

Ordering Information:
DK Publishing, Inc.
Customer Service
7800 Southland Boulevard,
Suite 200
Orlando, FL 32809
Fax: (800) 260-7658
Toll-free: (800) 986-9921
http://www.dk.com/

$4.21 per book

Intended for both novices and more advance computer users, this book offers hints and ti for using the Internet. It is divided into eight sections, each dealing with a separate aspect the Internet. The book begins by explaining what the Internet is and some of the jargon associated with it. The author then describes what equipment is needed to get connected, how a modem works, how to select a mode and what to consider before choosing a servi provider. The next section explains how to establish an email account and how to send a receive email. The book then provides instructions for downloading files using File Transfer Protocol (FTP). The next section discusses th web and topics such as hypertext, web browsers, search strategies, plug-ins, and search engines. The following section describ how Telnet functions and how newsgroups operate on the Internet. The final section discusse aspects of online chatting, includin locating chat sites, exploring the environment, and online gaming. (Author/DJS) ENC-009897



BEST COPY AVAILABLE

Exploring the Internet with NASA

Grades K-12
1997
Author: written and produced by Kevin Hughes

Ordering Information
NASA Headquarters
Educational Division
NASA CORE/Lorain County JVS
15181 Route 58 South
Oberlin, OH 44074
Telephone: (440) 774-1051
Fax: (440) 774-2144
nasaco@leeca.esu.k12.oh.us
http://spacelink.nasa.gov/CORE

$5.00 per CD-ROM (Macintosh/Windows)
Order # 400.0-81

System Requirements:
Windows: 486 (Pentium recommended); Windows 3.1 (Windows 95 recommended); 6MB RAM; 640x480 256-color display; 2x CD-ROM drive; sound card

Macintosh: Power PC; 6 MB RAM; System 7.0; 640x480 256-color display; 2x CD-ROM drive

The Internet tutorial on this CD-ROM takes students and first-time adult users on a futuristic journey through cyberspace in a souped-up Spanish galleon. New online explorers will discover what the Net is, what it's used for, and how to navigate it. Throughout the cyberjourney, users will meet a variety of animated characters who explain the Internet through color illustrations, video clips, three-dimensional animations, and music. Users also have the opportunity to practice using navigation buttons and hyperlinks and doing web searches. In addition to the tutorial, the CD-ROM contains samples from several NASA Internet sites and an electronic library of NASA resources for educators. (Author/LCT) ENC-011775

EXPLORING
INTERNET
NASA

Through the Glass Wall: Computer Games for Mathematical Empowerment

http://www.terc.edu/mathequity/gw/html/gwhome.html

Grades 1-8
1998
Author: project staff, Jan Mokros, Andee Rubin, Megan Murray, Marlene Kliman, Scot Osterweil, Brian King, Alana Parkes, Cara DiMattia, Kim O'Neil, Nicola Yelland
Publisher: TERC

Funding: National Science Foundation (NSF)

The software evaluations on this site are the result of a National Science Foundation funded research project that spent two years looking at how girls and boys play mathematical computer games. This web site contains descriptions of more than 50 computer games with reviews, sample dialogue, and suggestions about how to make the most of the mathematics in the games. Also found at this site are a description of how the software was evaluated and an explanation of the methodology used in the study. Another important goal of this project was to gather resources on relationships among computer games, mathematics knowledge, and gender. This information is found in a bibliography of related web sites and print sources. See article on page 23. Winner, ENC Digital Dozen, January 1999. (Author/JRS) ENC-013763

NCTM Yearbook Series

Calculators in Mathematics Education

Grade K and up
1992
Author: 1992 yearbook editor, James T. Fey; general yearbook editor, Christian R. Hirsch

Ordering Information:
National Council of Teachers of Mathematics, Inc.
1906 Association Drive
Drawer A
Reston, VA 20191-1593
Telephone: (703) 620-9840
Fax: (703) 476-2970
Toll-free: (800) 235-7566
orders@nctm.org
http://www.nctm.org/

$22.00 per book
Order # 484E1

Standards: NCTM Curriculum and Evaluation Standards (1989)

This yearbook provides a collection of articles on the impact and potential of calculators for mathematics instruction. The first of six sections identifies how calculators can influence both the content and process of mathematics instruction on all levels. In the second section, readers can explore ways that calculators are used successfully for mathematics instruction in the primary through the middle grades. The third section addresses calculator use in high school and college mathematics, from algebra to calculus and discrete mathematics. Reports in the fourth section describe how calculators influenced testing in state assessment programs and college admissions. The fifth section provides strategies for implementing calculator use in situations ranging from individual classrooms to the entire state. Finally, the last section contains descriptions of classroom calculator activities that illustrate some of the new instructional possibilities. References for each article are included. (Author/LDR) ENC-007846

Computer Equity in Math and Science: A Trainer's Workshop Guide

Grades K-12
1991
Author: Jo Sanders and Mary McGinnis; developed by the staff of the New York State Computer Equity Project at Women's Action Alliance, Inc.

Ordering Information:
Scarecrow Press Inc.
15200 NBN Away
PO Box 191
Blue Ridge Summit, PA
17214-0191
Telephone: (747) 794-3802
Fax: (800) 338-4550
Toll-free: (800) 462-6420
http://www.scarecrowpress.com/

$25.00 per manual

Funding: National Science Foundation (NSF)

The strategies in this binder of workshop materials are designed to help teachers and administrators gain skills in overcoming girls' computer avoidance, thereby promoting girls' interest in mathematics, science, and computers. In a sample activity, Looking at the Software, participants work in small groups to assess, from an equity point of view, a piece of software commonly used in a math or science classroom. Groups complete a worksheet about sexual stereotyping, levels of violence and competition depicted, and relevancy of the material to the real world. A whole-group discussion of the evaluations follows. The resource section contains a bibliography of materials that deal with girls and women in math and science, sources of models for equity conferences and workshops, and related classroom activities and materials. Also included are templates for overhead transparencies and handouts. (Author/JRS) ENC-014094

Studies of Education Reform Series

Technology and Education Reform

Grades K-12
1997
Author: prepared by Barbara Means, Kerry Olson with the assistance of Joan Ruskus, Edys Quellmalz, Teresa Middleton, Katie Ann Kaattari, Catherine Cobb Morocco, Arlene R. Remz, Judith Zorfass
Publisher: United States Department of Education, Office of Educational Research and Improvement

Ordering Information:
United States Government Printing Office (GPO)
Superintendent of Documents
PO Box 371954
Pittsburgh, PA 15250-7954
Telephone: (202) 512-1800
Fax: (202) 512-2250
Toll-free: (888) 293-6498
orders@gpo.gov
http://www.access.gpo.gov/su_docs/sale/prf/prf.html

$14.00 per book (paperback)
Order # 065-000-00934-0

Funding: United States Department of Education, Office of Educational Research and Improvement (OERI)

This book addresses the question of whether technology can provide significant support for constructivist, project-based teaching and learning approaches. The authors also consider the elements needed for an effective implementation of technology within an educational reform context. The series consists of 12 studies that focus on nationally significant education reform and restructuring efforts across the country. This book contains nine case studies of schools with students from economically disadvantaged backgrounds; each school is using technology to enhance a restructuring of the classroom with project-based activities. Students at these sites are involved in projects with real-world relevance that are also multifaceted, incorporating design, composition, analysis, and writing in interdisciplinary areas. One case study highlights a newly reopened technology magnet school serving minority, low-income students. The success of this middle school is attributed to the organization of teachers and students into teams, 90-minute block scheduling with extensive access to technology, and site-based management. Measures of success for this school include high attendance rate, good scores on districtwide testing, and high teacher satisfaction. The authors conclude that the press for reform is worthwhile, but that reform efforts take time to develop, require significant resources, and must address teachers' needs for support in undertaking both new learning and more difficult roles. References are included. (Author/JRS) ENC-012565

ASCD Yearbook Series

Learning with Technology

Grades K-12
1998
Author: edited by Chris Dede

This yearbook, produced for educators by the Association for Supervision and Curriculum Development (ASCD), is a collection of writings that focus on exemplary technology projects with the potential to revolutionize schooling for the 21st century. The editor and contributing authors find computers and communication to be powerful means to improve educational outcomes for all students. Discussed are new media tools to create a richer curriculum by bringing authentic, complex questions into the classroom; tools with the potential to help create more effective organizational structures in schools and to form stronger links between school and society; and tools to improve learning for children with various types of disabilities. Some of the questions addressed in this book include: How can schools afford the computers and telecommunications necessary to sustain the new models of teaching and learning described? How can educators uninterested in or phobic about technology be induced to adopt these new models of teaching and learning? Articles are relatively self-contained and each set of authors provides web sites and references for further exploration. (Author/JRS) ENC-012095

Ordering Information:
Association for Supervision and Curriculum Development
1703 N. Beauregard Street
Alexandria, VA 22311-1714
Telephone: (703) 578-9600
Fax: (703) 575-5400
Toll-free: (800) 933-2723
member@ascd.org
http://www.ascd.org/

$15.95 per book (ASCD member's price)
Order # 198000
Note: Non-member's price $18.95.

Contemporary Issues Series

Issues in the Information Age

Grades 6-9
1999
Author: Harry Henderson

Ordering Information:
Lucent Books/ Greenhaven Press
PO Box 289011
San Diego, CA 92198-9009
Telephone: (619) 485-7424
Fax: (619) 485-9549
Toll-free: (800) 231-5163
info@lucentbooks.com

$22.45 per book (library binding)
Note: Schools and libraries receive 20% discount off the list price, and discounts on sets and/or multiple copies.

Each book in the Contemporary Issues series dissects a contemporary, often controversial, topic into debates that offer multiple perspectives. This book examines four technology issues: computers in the classroom, Internet censorship, privacy, and the social implications of relating in cyberspace. The chapter on Internet censorship presents the viewpoints of free speech advocates, antipornography crusaders, Internet experts, and librarians in a debate over the rules of the road for the information superhighway. It also discusses the pros and cons of some potential solutions, such as the Communications Decency Act and blocking software. Another chapter examines the opportunities for sharing cultural and recreational interests in cyberspace and the importance of dealing with real-world relationships and the physical environment. Bibliographic references, a glossary, and contact information for national organizations are also provided. (Author/LCT) ENC-014453

Blueprints On-Line

http://project2061.aaas.org/tools/bluepol/blpframe.html

Grades K-12
1997
Author: Project 2061 staff and commissioned experts
Publisher: American Association for the Advancement of Science, Project 2061

Standards: Project 2061 (1985)

Designed for teachers, parents, policy makers, and business leaders, this web site is a summation of reports on a dozen areas of education. Part of Project 2061, this online version of the study views education as a system and educational reform as systemic reform. As such, the study reports on topics such as equity, assessment, teacher preparation, and community involvement. Additional topics include school organization, higher education, and technology. For each topic, the study provides an overview as well as recommendations for future actions. Topics are categorized into three major groups: societal aspects of the educational process, the school context, including curricula, technology, and assessment; and the support structure, which consists of teacher education and community involvement. The site also provides a detailed list of resources and contacts, complete with a brief description and web links where available. An online discussion forum is maintained for parents, educators, and policy makers to discuss the Blueprints and their implications. The discussion forum is organized by question. For example, as of the date of this abstract, one question was, "How can we balance the need for assessments to assure improvement and accountability with their time requirements and cost?" A search engine allows users to search the Blueprints for particular words and phrases. (Author/RMK) ENC-013373

CyberStories Series

Students as Experts

Grades K-12
1998
Author: Lynn Clark; editor, Elisse M. Gabriel; senior product developer, Sandra Wood

Ordering Information:
Classroom Connect Inc.
431 Madrid Avenue
Torrance, CA 90501
Telephone: (310) 618-0109
Fax: (888) 801-8299
Toll-free: (800) 638-1639
connect@classroom.com
http://www.classroom.com/

$19.95 per book (paperback)
Order # STO-1040-C182

The CyberStories series contains stories from teachers who have provided their students with the opportunity to do activities based on information they learned on the Internet. The students involved in the stories come from a variety of socioeconomic and cultural backgrounds as well as from different grade levels. The three stories in this book are about students gaining expertise in science and technology by using the Internet. After each story, there is an interview with the storyteller and guidelines that can be used to create a similar project. One story is about high school students who take on the role of history expert for elementary school students. The high schoolers researched web sites during their free time to develop activities and gain the necessary information to play their roles. They attended and performed labs with the elementary students each week from September to May. The class sold T-shirts to raise money, which they combined with grant money and other funds to cover the expenses of the project. At the end of the chapter, readers will find web sites for information on experts and related lab activities as well as alternative ways for students to present their information. An eight-step plan and additional web sites can help teachers design a project of their own. (Author/JSR) ENC-013899

Tales from the Electronic Frontier: First-Hand Experiences of Teachers and Students Using the Internet in K to 12 Math and Science

Grades K-12
1996
Author: Bill Barnes, Caroline Brennan, Susan Hixson, Glenn Lidbeck, Greg Lockett, Linda Maston, Kristine Mueh, Karen Nishimoto, Rory Wagner, Joanna Yantosh; edited by Mayumi Shinohara, Richard Wenn, Art Sussman

Ordering Information:
WestEd Eisenhower Regional Consortium for Science and Mathematics Education
Marketing/Communications
730 Harrison Street
San Francisco, CA 94107
Telephone: (415) 546-6481
Fax: (415) 241-2746
http://www.WestEd.org/

$9.50 per booklet
Order # TALE-96-01

Funding: US Deparment of Education

In this book, 10 teachers recount actual experiences using the Internet in K-12 science and mathematics classrooms. The stories illustrate how this technology can be used in different contexts and for different purposes. For example, an eighth grade class used an older computer to access the Internet to find information and inexpensive equipment to investigate the carbon dioxide levels in their school; fourth graders used email to initiate a collaborative project to determine the magnetism of Earth around the globe; and two high school seniors used remote access to record images of deep space objects. Additional topics include software compatibility, designing online projects, publishing student projects electronically on the World Wide Web, and using the Internet to prepare for field investigations. Sidebars provide technical information such as how to use email and choose a service provider; how to access online resources and free, downloadable software; image processing; and Internet etiquette. For each story, the text addresses instructional issues such as how the content may translate to other situations, urban environmental education, project based science, developmental and curricular issues, variables affecting student data, and accommodating students with disabilities. The web version of this publication (http://www.wested.org/tales/) was a winner, ENC Digital Dozen, December 1996. (Author/LCT) ENC-004277

web-based professional development

Teacher2Teacher

http://www.forum.swarthmore.edu/t2t/

Grades K-12
Author: a collaboration of The Math Forum and The Council of Presidential Awardees in Mathematics (CPAM)
Publisher: Swarthmore College

Funding: National Science Foundation

This web site is designed to answer teachers' questions about teaching mathematics and parents' questions about the ways their children are learning mathematics. A panel of teaching professionals, the Presidential Awardees for Excellence in Mathematics Teaching, is available to answer questions. Topics at this site range from classroom teaching techniques to finding good Internet resources for professional development. Users can search for ideas by grade level or by topic. There are topic references for learning multiplication tables, teaching elapsed time, and questions on Advanced Placement Calculus. Posted replies to questions include suggestions for using technology with advanced middle schoolers, information about mathematics in the workplace, and factoring trinomials. There are links to many other sites related to the teaching and learning of mathematics. Winner, ENC Digital Dozen, December 1998. (Author/JRS) ENC-013002

Math Teacher Link
Courses and Tutorials for Mathematics Teachers

http://www-cm.math.uiuc.edu/mtl/courses.html

Grade 9 and up
Publisher: University of Illinois, Urbana-Champaign

Standards: NCTM Curriculum and Evaluation Standards (1989)

Part of Math Teacher Link, this web site offers a series of online courses on educational technology and mathematics for teachers at the high school and lower-division college levels. Several of these tutorials and modules are also offered as graduate-level courses for math teachers through the University of Illinois. The site provides course descriptions and information on registration and computer requirements. One example is the workshop called Algebra Through Modeling with the TI-82 Calculator, which was developed to familiarize teachers with content and teaching strategies for advanced algebra using the calculator. The module presents a nontraditional teaching perspective that stresses modeling and real-world problem solving. This approach is intended for students who have completed two years of algebra but are not ready for precalculus. Students work in a collaborative learning environment and make extensive use of graphing calculators. Also available are interactive tutorials introducing the use of the TI-82 and data-fitting. The Teacher Link modules can be directly downloaded from this site. (JRS/TAH) ENC-011896

Teacher Change: Improving K-12 Mathematics

http://change.enc.org/

Grades K-12
Publisher: Eisenhower National Clearinghouse

Standards: NCTM Curriculum and Evaluation Standards (1989); NCTM Professional Standards (1991)

Funding: US Department of Education

Designed for professional developers and educational leaders working with teachers, this web site provides a collection of materials intended to facilitate discussion, reading, reflection, learning, and change related to improving mathematics teaching and learning. The materials include essays on teacher change, cases and stories about teaching practices in the US and other countries, professional development activities, and descriptions of curriculum materials that support changes in classroom practices. Data and resources from the Third International Mathematics and Science Study (TIMSS) are integrated throughout this project and provide the backdrop for the dialog about change in mathematics classrooms. Winner, ENC Digital Dozen, May 1999. (Author/GMM) ENC-014838

WWW.4teachers

http://www.4teachers.org/

Grades K-12
Author: South Central Regional Technology in Education Consortium

Funding: US Department of Education

At this monthly, web-based publication, educators and all interested others can encounter new ideas about technology's role in education. They can express their opinions, share experiences, and be inspired and educated by other teachers' narratives about using technology in educational settings. The site features interviews, web lessons, and surveys as well as online lesson plans that guide students through an annotated set of sites (URLs) on such subjects as language arts, science, mathematics, and research in teaching. (Author/LCT) ENC-010903

Exploring Data

http://curriculum.qed.qld.gov.au/kla/eda/

Grades 10-12
Author: Rex Boggs
Publisher: Brisbane, Queensland (Australia) Department of Education

System Requirements: Best viewed with Netscape 3.0 or Internet Explorer 3.0 or later, with Java enabled. Some documents on this site created as HTML and Word 2.0 files. Excel 4.0 or NCSS Jr. 6.0 also helpful for use of data sets.

Developed by the head of mathematics of an Australian high school, this web site provides curriculum support for teachers of introductory statistics. The site contains activities, worksheets, and overhead transparency masters. Also provided are data sets, stories about their origins, and assessment to support data exploration. Underlying themes are the importance of extending teachers' knowledge of statistics and the central place of real data in students' understanding of the subject. To assist in the exploration of concepts such as stemplots, normal distribution, and probability, the site offers notes to the teacher on the meaning and relevance of the concept, plus extension articles. Furthermore, activities on a concept are outlined and accompanied by sets of real data. A resource page contains a list of resources available to support introductory statistics. Links to tutorials and other mathematical web sites are included. Winner, ENC Digital Dozen, February 1998. (Author/JRS) ENC-011678

Fermilab LInC

http://www-ed.fnal.gov/lincon/index.html

Grades K-12
Author: Laura Mengel, Liz Quigg and Kris Ciesemier
Publisher: Fermi National Accelerator Laboratory

At this web site, Fermilab provides a course teacher-leaders can use to give inservice training on integrating Internet resources into the curriculum. The training includes topics such as identifying effective teaching strategies for using telecommunications, learning how to find and access Internet resources, and publishing documents on the Internet. Users have access to LInC course materials that are broken down by grade level. The LInC Project Index provides access to projects designed by K-12 teachers who participated in Fermilab's staff development program. For one project, Wetlands in Danger, elementary students identify the issues and concerns facing local wetlands. Links are provided to additional education sources for students, educators, and the public. Winner, ENC Digital Dozen, March 1997. (Author/FEB) ENC-009312

Educational Media and Technology

http://itdc.sbcss.k12.ca.us/

Grade K and up
Author: Instructional Technology Development Consortium

The Educational Media and Technology consortium is a group of California school districts dedicated to using the Internet as a tool for providing and promoting technology for today's curriculum. A section on curriculum resources offers webquests, which are Internet projects for students, as well as teacher-developed lesson plans with guidance about using Internet resources. In one lesson, Living with the Sun—Preventing Skin Cancer, students in grades 5-8 research the effect of ultraviolet sun rays on skin and ways that students can prevent skin cancer. Students design a presentation, do a related science experiment, or create a total promotional package for a skin-care product as part of the two- to three-week lesson. A list of Internet and non-Internet resources and guidelines for evaluation accompany the lesson. Also available at this site are links to professional development opportunities for teachers and information about joining EMT. Winner, ENC Digital Dozen, February 1998. (Author/JRS) ENC-011612

Technology & Learning Online

http://www.techlearning.com/index1.html

Grades K-12
Author: the editors of *Technology & Learning* magazine

This web site presents an online version of *Technology & Learning*, a magazine created for school administrators, teachers, and technology coordinators. The site offers information on grants, web searching tips, contests, and technology events for teachers, schools, and students. Also included is a searchable database with reviews and manufacturer information about educational technology products. Winner, ENC Digital Dozen, July 1999. (Author/JRS) ENC-013283

MCI Worldcom MarcoPolo: Internet Content for the Classroom, Teacher Training Kit

http://www.wcom.com/marcopolo/training/index.shtml

Grades K-12

MarcoPolo is an Internet-based learning initiative sponsored by MCI in partnership with the American Association for the Advancement of Science, the National Endowment for the Humanities, the National Council of Teachers of Mathematics, the National Council on Economic Education, and the National Geographic Society. It is a professional development training program designed to help teachers integrate the Internet into their curriculum. The site features professional development workshop materials designed for educators who know how to use a computer. All materials are downloadable and include a leader's guide with directions for implementing the program, presentation notes, and reproducible handouts for program participants. Additional MarcoPolo resources include five Internet sites for science, mathematics, geography, humanities, and economics. Science Netlinks, for example, provides science teachers with Internet resources appropriate to the K-12 curriculum, including links to national standards organizations and standards-based lesson plans. Other sites include Xpeditions for K-12 geography; EDSITEment with Internet resources for teachers of literature, history, social studies, foreign languages, and art history; Illuminations for K-12 Mathematics; and EconEdLink with resources for adding economic insight to the social studies, mathematics, geography, business, language arts and science curricula. Winner, ENC Digital Dozen, June 1999. (Author/LCT) ENC-014837

integrating technology

LPD Video Journal of Education

The Technology-Infused High School Classroom

Grades 9-12
1998
Author: presented by Nancy Sulla
Publisher: Professional Development Corporation (LPD)

Ordering Information:
The Video Journal of Education
8686 South 1300 East
Sandy, UT 84094
Telephone: (801) 566-6500
Fax: (888) 566-6888
Toll-free: (800) 572-1153
http://www.videojournal.com/

$345.00 per videotape package
Order # 705H
Note: Includes 2 videotapes, 1 guidebook, and 1 audiotape. Other ordering options available. Contact publisher for information.

Journey into high school classrooms to see how technology can facilitate active learning. These videos present strategies for infusing educational technology as an integral part of instruction. The Video Journal of Education is a video-based staff development program designed to present current educational research and issues to school boards, administrators, and teachers. Each program features a presentation by a nationally recognized expert as well as practical examples from secondary classrooms throughout North America. Much like a periodical, each annual volume contains nine issues, and each issue includes two videos, an audiotape containing both video soundtracks, and a guidebook to facilitate group discussion. In this issue, Nancy Sulla presents the design of learner-active, technology-infused classrooms in which technology has become an essential tool in developing projects and solving problems. Part one of the program defines technology infusion and explains how technology contributes to problem-based learning. In part two, Sulla describes her technology hierarchy model that organizes educational technology from lower level drill-and-practice tutorials and books on CD-ROM to more empowering levels of the Internet. Additional topics include classroom management techniques and assessment rubrics. The guidebook contains a brief introduction to the program, an outline to facilitate viewing, and pre- and post-viewing discussion questions. It also provides reproducible masters of a technology implementation plan and a sample assessment rubric. Separate videotape issues are available for elementary and middle school levels. (Author/LCT) ENC-014415

Great Teaching in the One-Computer Classroom

Grades K-12
1998
Author: David A. Dockterman

Ordering Information:
Tom Snyder Productions, Inc.
80 Coolidge Hill Rd
Watertown, MA 02172-2817
Fax: (617) 926-6222
Toll-free: (800) 342-0236
http://www.teachtsp.com/

$19.95 per book (paperback)
Order # T-DOC

This teacher resource book is designed to help teachers use computer technology to create a dynamic classroom experience. Ideas include how technology can ease administrative burdens, enliven classroom presentations, and spark student discussions while fostering cooperative learning and critical thinking. One of the topics addressed in the book is the issue of creating a computer lab or placing a limited number of computers in classrooms. In one chapter, the author explains and illustrates the use of interactive group software to create opportunities for student learning and interaction. Dockterman also explains the use of the Internet in self-contained classrooms with limited computer availability. The book expounds upon the need for a paradigm shift so that teachers see alternatives to the idea that computers are for individual use only. An appendix contains step-by-step instructions for such things as building a slide show or creating a grade book. Additional resources and helpful Internet sites are also suggested. A glossary is included. (Author/JRS) ENC-013824

The Online Classroom: Teaching with the Internet

Grades K-12

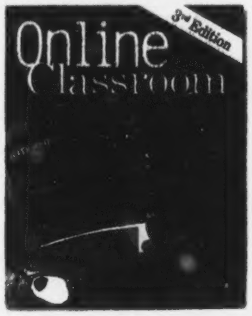
1998
Author: Eileen Giuffre Cotton
Publisher: EDINFO Press

Ordering Information:
Classroom Connect Inc.
431 Madrid Avenue
Torrance, CA 90501
Telephone: (310) 618-0109
Fax: (888) 801-8299
Toll-free: (800) 638-1639
connect@classroom.com
http://www.classroom.com/

$34.95 per book (paperback)
Order # RES-1030-C182

Funding: US Department of Education, Office of Educational Research and Improvement

Designed to help K-12 teachers integrate the Internet into their classrooms, this book explains the basics of the Internet, discusses searching strategies and techniques, and contains ideas for implementing the Internet into instruction. The contents are presented in a table that correlates the chapters with appropriate grade levels and the technology required for each activity. Teachers will find recommended web sites, suggestions for acceptable use policies, and tips for successful use of search engines. The book explores the pros and cons of directories and search engines and discusses how to conduct Boolean searches. Additionally, teachers can learn how to develop and design their own web sites using HTML coding and avoiding common pitfalls in web design. In the second half of the book are specific activities, each of which includes Internet links and a rubric for evaluating the work. One activity shows the students how to write a resume to help them apply for a job. They can go to sample resumes or resume guides on the Internet to learn how to write their own or one for a given historical figure. The chapter includes Internet sites that have career information and resume writing tips. Reproducible worksheets are found throughout the text. Selected Internet books are cited in a bibliography, and a glossary defines Internet terms. (Author/JSR) ENC-013851



Internet Curriculum Integration Series

Curriculum Integration 101

Grades K-12
1996
Author: writers/producers/directors, Kevin Martorana, Steve Nosoff

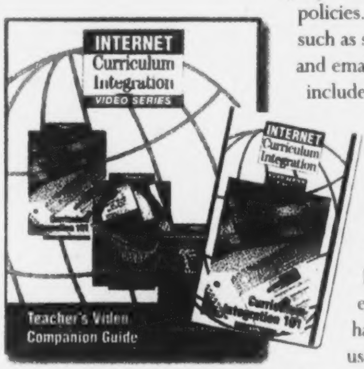
Ordering Information:
Classroom Connect Inc.
431 Madrid Avenue
Torrance, CA 90501
Telephone: (310) 618-0109
Fax: (888) 801-8299
Toll-free: (800) 638-1639
connect@classroom.com
http://www.classroom.com/

$59.95 per video
Order # VCU-1020-C182

$19.95 per teacher's guide
Order # VCU-1050-C182

$159.00 per series (3 videotapes/1 teacher's guide)
Order # VCU-1010-C182

Featuring interviews with teachers around the country, the Internet Curriculum Integration Video Series is designed to help facilitate integration of the Internet into the classroom. The intent is to help teachers enhance their lesson plans and class activities with Internet components. In the interviews, teachers offer ideas and examples of how to turn traditional lesson plans into Internet plans. In this video, teachers discuss how the Internet has made their lessons more exciting. An example they give is how they turned a traditional meteorology lesson into an interactive exploration in which students collected satellite images and global weather data from the Internet. The students were able to make predictions about the weather in a specific location and send their predictions to a class in a school in that area. Another mode of communication used by a teacher interviewed is Usenet news groups: the teacher describes how the news group's bulletin boards opened up a vast audience for his students. The video also addresses the issues of managing Internet use in schools and developing and implementing acceptable use policies. It explains Internet tools such as search engines, web browsers, and email. The companion guide includes tips, case studies, and definitions of technical terms. Sample lesson plans include grade levels, objectives, materials, and extensions. A flow sheet explains the steps needed to develop new Internet lesson plans and projects. The accompanying guide has a template for an acceptable use policy and explanations about how to cite Internet resources. The book and video both include web site addresses, descriptions, and recommendations. (Author/JSR) ENC-013920


INTERNET
Curriculum Integration
VIDEO SERIES
Teacher's Video Companion Guide
INTERNET Curriculum Integration
Curriculum Integration 101

TechKNOWLEDGEy Series

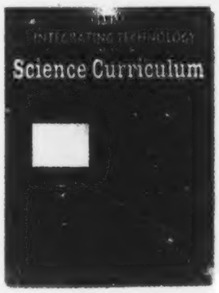
Integrating Technology into the Science Curriculum: Primary

Grades K-3
1998
Author: Diane Donato; illustrator, Agi Palinay

Ordering Information
Teacher Created Materials, Inc.
6421 Industry Way
Westminster, CA 92683
Fax: (800) 525-1254
Toll-free: (800) 662-4321
http://www.teachercreated.com/

$12.95 per book (paperback)
Order # TCM2427

The TechKNOWLEDGEy series contains management ideas for single- and multiple-computer labs, ways to organize records, and suggestions for lesson plans and activities that facilitate the use of technology in the curriculum. The 34 integrated lesson plans in this book cover biological, physical, and Earth science topics, such as animals, energy, and weather. Each lesson includes a materials list, procedures, and instructions for what should be done before, during, and after the students start to use the computers. Data sheets, blackline masters, and web links for follow-up activities are also provided. In one lesson on the plant cycle, students begin by starting seeds in a pie pan containing pebbles



and soil. The children keep journals with their observations of the plant growth. After the plants have emerged, the students make drawings of the plants, use the computers to create covers for their journals, and compile the drawings and cover into a group journal. The lesson includes suggestions for extensions, such as a slide show or a three-dimensional life cycle. Teachers can go to an Internet connection to receive additional gardening information. The book also provides ideas concerning assessment, the Internet, and grant writing. (Author/JSR) ENC-013959

TechKNOWLEDGEy Series

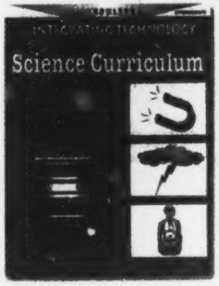
Integrating Technology into the Science Curriculum: Intermediate

Grades 4-8
1999
Author: Paula G. Patton; editor, Charles Payne

Ordering Information
Teacher Created Materials, Inc.
6421 Industry Way
Westminster, CA 92683
Fax: (800) 525-1254
Toll-free: (800) 662-4321
http://www.teachercreated.com/

$12.95 per book (paperback)
Order # TCM 2428

Part of the series described above, this book covers different hardware equipment including computers, laserdiscs, and digital cameras. It also suggests some software programs and Internet links that can be used in the activities. It contains 49 lesson plans on biological and physical science topics, including plants, ecology, space, and matter. Teachers are told what should be done before and during computer use. Follow-up related activities and Internet links are offered. One grade five lesson on plant processes describes an experiment in which students can observe colored water moving up the vascular tissue in celery. Before they use the computer, the students perform the experiment, have a class discussion about the results, and become familiar with a word processing program that allows them to draw tables. Once at the computer, students construct a results table, discuss the results, and print out their work. They are then given an Internet link on the topic. Resources and additional references are included. (Author/JSR) ENC-013781



TechKNOWLEDGEy Series

Integrating Technology into the Science Curriculum: Challenging

Grades 5-8
1999
Author: Debi Hooper; editor, Charles Payne; illustrator, Ken Tunell

Ordering Information
Teacher Created Materials, Inc.
6421 Industry Way
Westminster, CA 92683
Fax: (800) 525-1254
Toll-free: (800) 662-4321
http://www.teachercreated.com/

$12.95 per book (paperback)
Order # TCM 2429

Part of the series described in the preceding record, this book is designed to provide technology coordinators, resource teachers, media specialists, and classroom teachers with ideas about integrating computers and peripheral devices into the science curriculum. Topics covered include computer systems, software licensing, and telecommunications requirements. Also included is information concerning acceptable use policies and other lines of defense to ensure appropriate use of the Internet. In addition, the book suggests techniques for time and behavior management. The book's 30 lesson plans cover topics such as animals, chemistry, the solar system, and weather. Teachers are given additional options for conducting the activities. Web links for follow-up activities are found in each lesson plan. One lesson deals with analyzing owl pellets in an activity that should take one to two class periods with additional time for data entry on the computer. Students inspect the owl pellets externally and internally, retaining any bones for identification and display. They record their findings on the data sheet provided and then enter them into the class database on the computer. Other lesson options include comparing pellets of different raptors or pooling data with classes from different schools. The lesson plan ends with web links about owl pellets and owls. Also provided are ideas for science fair project management, global telecollaboration with other classes, and other methods for integrating technology into the curriculum. (Author/JSR) ENC-013782

Science Curriculum

BEST COPY AVAILABLE

math lessons

Teaching with the Internet Series

Teaching Mathematics with the Internet

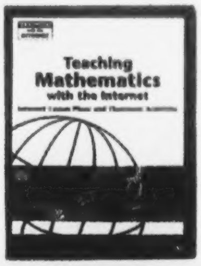
Grades 7-12
1998
Author: Marc Alan Rosner; editor, Todd Frey; senior editor, Kathleen Housley

Ordering Information:
Classroom Connect Inc.
431 Madrid Avenue
Torrance, CA 90501
Telephone: (310) 618-0109
Fax: (888) 801-8299
Toll-free: (800) 638-1639
connect@classroom.com
http://www.classroom.com/

$29.95 per book (paperback)
Order # TWI-1050-C182

Standards: NCTM Curriculum and Evaluation Standards (1989)

This resource book, part of Teaching with the Internet series, offers step-by-step Internet lesson plans, online projects, and classroom activities that aim to apply mathematics to real-life situations. Each of the seven books in the series includes a dedicated web site, maintained by the publisher, that lists all the URL addresses cited in the lesson plans. This book contains secondary school lesson plans that are multidisciplinary, connecting mathematics to subjects that include history, engineering, and science. In a sample lesson, the Geometry of Visual Perspective, students learn how artists use geometry to create the illusion of three-dimensional space in two-dimensional media. As students review a web tutorial on perspective, they apply the idea of vanishing point by trying to draw a railroad track and a hallway using perspective. They then compare their results with a solution found at the site. This lesson requires accessing at least four web sites, which is made easy to do by the dedicated web site listed at the front of the book. Each lesson plan contains an overview, objectives, materials, and procedure along with reproducible student activity sheets. An answer key is included. (Author/JRS) ENC-014149



Data Collection Activities for the Middle Grades with the TI-73, CBL, and CBR

Grades 5-8
1998
Author: Ellen C. Johnston, David A. Young

Ordering Information:
Texas Instruments, Inc.
Customer Relations
M/S 3962
7839 Churchill Way
Dallas, TX 75251
Telephone: (972) 917-6335
Fax: (972) 917-0747
Toll-free: (800) 842-2737
ti-cares@ti.com
http://www.ti.com/

$23.75 per book
Note: Instructional dealer price. Call 1-800-TI-CARES for vendor referral and pricing (TI indicates that dealers set prices).

Standards: NCTM Curriculum and Evaluation Standards (1989)

This book of data collection investigations integrates mathematics and the sciences, with the intent of meshing scientific concepts with the mathematics that is behind them. The investigations were designed to be used with a graphing calculator for the middle grades (such as the TI-73) and calculator accessories including data collection probes. For each investigation, the student activity pages contain an introduction that describes the context of the investigation. Specific data-collecting instructions are provided for student groups to use during the activity. Also included is a section that can be used for assessment, homework, or as an extension. Data collection and analysis sheets are included. The teacher notes for each investigation give tips regarding safety, set-up, and pitfalls; specific math and science content information; and suggested answers for student worksheets. In a sample activity, students estimate and then measure the coasting distances for toy cars on an inclined ramp. They determine the effect of position on the inclined plane in relation to the coasting distance traveled, then use this data to construct graphs on the calculator. Each of the 12 activities is correlated to the NCTM standards. (Author/JRS) ENC-013896

EXPLORATIONS

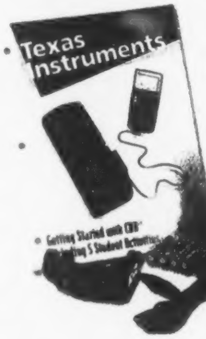
Calculator-Based Ranger (CBR)

Grades 6-12
1997

Ordering Information:
Texas Instruments, Inc.
Customer Relations
M/S 3962
7839 Churchill Way
Dallas, TX 75251
Telephone: (972) 917-6335
Fax: (972) 917-0747
Toll-free: (800) 842-2737
ti-cares@ti.com
http://www.ti.com/

$120.00 per Calculator-Based Ranger (CBR)
Note: Price is suggested; retail set by TI dealer. Call TI for more information.

With this Calculator-Based Ranger (CBR) and a Texas Instruments graphics calculator, students can explore the mathematical and scientific relationships between distance, velocity, acceleration, and time using data they collect. The CBR is a hand-held, calculator-based, sonic motion detector that can be used to collect, view, and analyze motion data. It eliminates the need to manually find measurements and plot data from experiments. The teacher's guide contains instructions for using the CBR, hints on effective data collection, and five classroom activities to explore basic functions and properties of motion. Each lesson includes a basic data collection activity, explorations that examine the data more closely, and suggestions for advanced topics appropriate for precalculus and calculus students. Also included is a reproducible student activity sheet with open-ended questions appropriate for a wide range of grade levels. In a sample activity, students attempt to duplicate graphs by walking around and watching how their motion is plotted. Once students have mastered the distance/time match, they are challenged to work with nonlinear graphs of velocity and time. (Author/JRS) ENC-013862



Algebra, Data, and Probability Explorations for Middle School: A Graphics Calculator Appr

Grades 6-8
1998
Author: Graham A. Jones and Roger Day

Ordering Information:
Cuisenaire Dale Seymour Publications
10 Bank Street
PO Box 5026
White Plains, NY 10602-5026
Telephone: (914) 328-5487
Toll-free: (800) 872-1100
http://www.awl.com/dsp/

$16.95 per book (paperback)
Order # EN501-21807

Standards: NCTM Curriculum and Evaluation Standards (1989)

The 88 hands-on activities and teacher notes in this book are designed to familiarize middle-school students with graphing calculators. The book is divided into three teaching modules. Module One: Algebra focuses on patterns and relationships as vehicles for developing algebraic reasoning. Module Two: Data emphasizes organizing, displaying, and interpreting data in various ways. Module Three: Probability incorporates simulations and analysis to determine both experimental and theoretical probabilities associated with real-world problems. Each module can be used as a replacement unit or as a supplemental unit. The teacher notes contain content background, suggestions for presentation, and problem solutions. For each activity, students are given problems to solve and directions to guide their investigation and discussion. In a sample activity, students determine if there is any relationship between the total points scored by players in a basketball game and the time spent on the bench. Students use information from a data set and a graphing calculator to construct a scatter plot for the variables. Discussion follows, and each class member writes a paragraph to describe the relationship between the variables. In the extension, students plot the relationship between total points scored and playing time in a 20-minute game, then look for similarities and differences between the two graphs. In addition, the book contains problems at three levels of difficulty, eight data sets, and 10 step-by-step calculator tips. A glossary is included. (Author/JRS) ENC-013636

The Geometer's Sketchpad: Dynamic Geometry for the 21st Century

Grade 5 and up
1995
Author: Nicholas Jackiw

Ordering Information:
Key Curriculum Press
1150 65th Street
Emeryville, CA 94608-1109
Fax: (800) 595-7040
Toll-free: (800) 995-6284
orders@keypress.com
http://www.keypress.com/

$169.95 per software package (Macintosh verison)
Order # 53025
Note: Student package, multiple-user packages, and site license or network packages are available. Contact publisher for details.

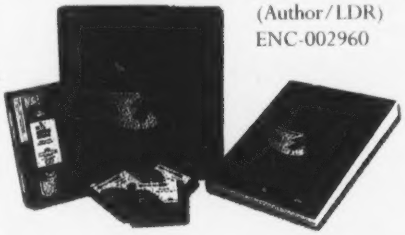
Standards: NCTM Curriculum and Evaluation Standards (1989)

Funding: National Science Foundation

System Requirements:
Windows: IBM or compatible 386 or better; 4 MB RAM or more; Microsoft Windows version 3.1 or higher

Macintosh: MacPlus or better; 1MB RAM or more; System 6.0 or higher

Designed to provide fast, precise, and accurate geometric figures and to reveal essential geometric relationships, this software package permits student investigation and teacher demonstration of geometric concepts. Geometric conjectures about real-world situations can be constructed and then dynamically explored. Students can use the electronic compass and straightedge to construct a triangle's circumcenter by constructing the perpendicular bisectors of the sides of the triangle. Dragging a vertex demonstrates that all triangles possess a circumcenter that is either in the interior, on a side, or in the exterior of the triangle. Sketches are created by drawing and combining objects (points, circles, segments, rays, and lines) to construct figures and to investigate geometric principles. In addition, verbal recordings or scripts elucidate geometric constructions of objects and their relationships to one another. The software provides presentation sketches, such as billiards, where a user can drag the cue stick to determine at what angle the ball must be hit to enter a desired pocket. Teaching notes and sample activities are included. (Author/LDR) ENC-002960



Shape Makers: Developing Geometric Reasonin with the Geometer's Sketchpad

Grades 5-8
1996
Author: editors, Dan Bennett and Casey FitzSimons; Geometer's Sketchpad software design, Nicholas Jackiw

Ordering Information:
Key Curriculum Press
1150 65th Street
Emeryville, CA 94608-1109
Fax: (800) 595-7040
Toll-free: (800) 995-6284
orders@keypress.com
http://www.keypress.com/

$39.95 per software package
Order # MK53292
Note: Requires Geometer's Sketchpad software. Contact publisher for specific system requirements.

Funding: National Science Foundation (NSF)

Math teachers can use this text and accompanying software for engaging students in using The Geometer's Sketchpad. Shape Makers was developed with the philosophy that instruction should be inquiry-based, with students learning mathematics as they solve problems and share their ideas. The text includes a discussion of how the program ties in to the van Hiele levels of geometric conceptual development. The materials are designed for use by pairs of students working to form conjectures as they explore each activity. In each set of explorations, students use different Shape Makers, which are templates for a given shape that preserve the properties of that shape. For example, the activity The Mystery of Polygon Flats asks students to discover which of six characters (played by different Shape Makers) committed a theft. To do this, students must analyze camera shots of the shapes in the various rooms and manipulate different Shape Makers to find a match with the security camera shots. Teaching notes discuss aspects of instruction as illustrated by teacher-student dialogs taken from actual classrooms. Mathematical notes deal with mathematical and pedagogical issues that require special attention. Student activity masters are included. See article on page 31. (Author/RMK) ENC-012573

Net Lessons: Web-Based Projects for Your Classroom

Grades K-12
1997
Author: Laura Parker Roerden
Publisher: Songline Studios, Inc. and O'Reilly & Associates, Inc.

Ordering Information:
Educators for Social Responsibility
23 Garden Street
Cambridge, MA 02138
Telephone: (617) 492-1764
Fax: (617) 864-5164
Toll-free: (800) 370-2515
educators@esrnational.org
http://www.esrnational.org/

$24.95 per book (paperback)

Net Lessons:
Web-Based
Projects
For Your
Classroom

Written by a teacher/curriculum designer, this book focuses on developing curriculum for using the web. It offers guidelines for getting started with Internet activities in the classroom and for enhancing the existing curriculum with technology. Also explained are design and implementation plans, assessment tools, and activity frameworks for developing web-based curriculum. There are more than 100 lesson plans for art and music, language arts, math, science, and social studies topics. In a sample lesson, A Taste of Trig, high school students participate in a three-week collaborative project for computing the angle of elevation of the sun by applying trigonometry. Students use email to gather data from participating classes in their time zone with a wide distribution of different latitudes. Each class measures the shadow cast by a 10-foot pole at a designated me and date for one week and daily calcu- ates the angle of the sun to Earth by using ie inverse tangent function. Classes compile nd post their data to the project coordina- ors who share data with all participating lasses. Student organizers observe the daily hanges in the sun's angle and the differences ound in the measurements at the different ltitudes. The appendix contains a listing of eb resources, organized by discipline, as ell as mailing lists and newsgroups helpful to the classroom teacher. Included is an America Online CD-ROM offering 50 free hours online. (Author/JRS) ENC-013993

Lessons Developed by Susan Boone

http://www.crpc.rice.edu/CRPC/GT/sboone/Lessons/lptitle.html

Grades 8-12
Author: Susan Boone
Publisher: Rice University

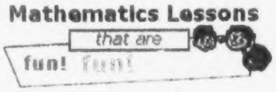
Houston high-school teacher Susan Boone developed this web site of problem solving lessons for algebra. Boone's lessons use the Internet as a source for information gathering. Sites for possible data collection are included in the lesson plans, as are a list of topics the lesson covers, its purpose, and the prior knowledge students must have. Each lesson also includes sample questions and possible extensions, as well as suggestions for raising students' consciousness about gender issues. Lessons address topics such as linear equations, unit price and proportions, and data collection and interpretation. Winner, ENC Digital Dozen, November 1995. (Author/GMM) ENC-004046

Mathematics Lessons That Are Fun, Fun, Fun!!!

http://math.rice.edu/~lanius/Lessons/

Grades 3-8
Publisher: Rice University

Standards: NCTM Curriculum and Evaluation Standards (1989)



The 15 lessons on this web site cover topics such as fractions, algebra, geometry, and calculus. Many lessons lead the student through a mathematical exploration, followed by links to lesson extensions. For example, in the lesson The Million $ Mission, students are asked to consider two salaries for a month-long mission: one cent the first day, two cents the second day, and double the salary every day thereafter; or exactly $1,000,000. In the scenario provided in the lesson, the student snaps up the million dollars and goes on the mission. The balance of the lesson is determining if that student made the better choice. Users examine tables documenting the actual amount of money earned each day and study the pattern of exponential growth. A graph shows the increase in salary over the period of 30 days. Lessons are often accompanied by teacher notes that may include ideas for the classroom and suggestions for assessment. Winner, ENC Digital Dozen, April 1999. (Author/GMM) ENC-014712

Networking Projects

http://www.glenbrook.k12.il.us/gbsmat/glazer/network.html

Grades 7-12
Author: Evan Glazer
Publisher: Northfield Township High School District 225

High school teacher Evan Glazer maintains this web site of student projects ready for classroom use. Each project begins with a problem-solving scenario, then provides a detailed list of requirements for carrying out the project and making a final report. Links to needed real data are given, as well as links to supplementary lessons. Problem contexts range from investigating stock market options to converting money to different currencies for use on a vacation. A sample activity, Chopping Broccoli, examines how fractals relate to the idea of similarity. An illustration shows the iterations that a square can go through as it is transformed into a more complicated figure. After viewing further examples in geometry and in nature, students are asked to define iteration and, finally, to explain how chopping broccoli relates to similarity and fractals. A class handout is provided and links are given for related sites. Winner, ENC Digital Dozen, May 1998. (Author/JRS/TAH) ENC-011990

Interactive Mathematics Miscellany and Puzzles

http://www.cut-the-knot.com/

Grade 5 and up
Author: Alexander Bogomolny
Publisher: SuperNet, Inc.

This web site contains interactive mathematical games and puzzles as well as information about the mathematical concepts used to create them. Games and puzzles include Magic Squares, Towers of Hanoi, and Nim, which can be played by the user and then explored through the author's in-depth discussions of the embedded mathematics. For example, What's Next requires the user to determine the next number in different types of sequences, including arithmetic and Fibonacci sequences. In other sections, visitors will find nonroutine problems accompanied by hints and one or more solutions. The problems serve as springboards to mathematical explanations of topics ranging from divisibility by seven to eight proofs of the Pythagorean Theorem, including one by President Garfield. Another page of this site provides a collection of Java applets that illustrate and thus help to solve and prove various math problems. Winner, ENC Digital Dozen, January 1997. (Author/LDR/TAH) ENC-002256

Math Cove

http://www.utc.edu/~cpmawata/

Grades 6-12
Author: Christopher P. Mawata
Publisher: University of Tennessee

Funding: University of Tennessee, Chattanooga; Center of Excellence for Computer Applications (CECA)

A professor at the University of Tennessee at Chattanooga Center for Applied Math created this web site of interactive activities and lessons on transformations and geometry. Also available are 23 graph theory lessons and an interactive puzzle, Trominos, that is formed by applying mathematical induction and recursion. The geometry lessons offer interactive activities for measuring angles, exploring types of angles, and adding angles. The triangle activities include a Java Applet that pictorially demonstrates a proof of the Pythagorean Theorem. The Instructor's Notes section contains Java applets for experimentation, instructions for learning to write applets, and an electronic paper discussing the use of Java applets in education. Winner, ENC Digital Dozen, April 1999. (Author/JRS) ENC-014313

Manipula Math with JAVA

http://www.ies.co.jp/math/java/index.html

Grade 5 and up
Author: International Education Software, Inc. (IES)

Standards: NCTM Curriculum and Evaluation Standards (1989)

The interactive animation on this site helps students explore an extensive set of sophisticated mathematical concepts. Each interactive program, or applet, presents a problem with opportunities for the student to do structured exploration. Relationships between variables presented in the problem can be manipulated; for example, in one applet, students can investigate the meaning of the Pythagorean Theorem, find the sum of the outer angles of a polygon, and calculate the volume of a solid of revolution. Students are able to generate, rotate, and transform three-dimensional figures. Topics include geometry, trigonometry, and calculus. Winner, ENC Digital Dozen, May 1998. (JRS) ENC-011230

NJNIE Project: New Jersey Networking Infrastructure in Education

http://njnie.dl.stevens-tech.edu/curriculum/currichome.html

Grades 3-12
Author: Stevens Institute of Technology

Standards: National Science Education Standards (December 1995); NCTM Curriculum and Evaluation Standards (1989)

The New Jersey Networking Infrastructure in Education (NJNIE) team provides this web site of projects that teachers can use to enhance their curriculum through use of the Internet. The site focuses on projects that utilize real-time data available from the Internet, as well as on collaborative projects that make use of the Internet's potential to reach peers and experts around the world. Each project has a brief description and links to the science and/or NCTM standards it supports. One project, The Stowaway Adventure, uses live remote-sensing data from cargo ships at sea to take students on a virtual adventure. Students learn about navigation and use mathematics to calculate their ship's average speed in knots. In a follow-up adventure, students use satellite and radar images to identify upcoming storms on the ship's course. In the Global Temperature Project, students from around the world team up to investigate the relationship between proximity to the equator and temperature and sunlight variations. In addition to projects, there is an Ask-an-Expert page that provides links to experts in a number of different fields. Winner, ENC Digital Dozen, May 1998, August 1999. (Author/JRS) ENC-012233 *science lessons*

Welcome to the Monarch Watch!

http://www.MonarchWatch.org/

Grades K-8
Author: Julie C. Ellis; Jim Lovett, Liz Smith
Publisher: University of Kansas, Department of Entomology

This web site covers the migration of the Monarch butterfly. The goals of Monarch Watch are to further science education, particularly in primary and secondary school systems, to promote conservation of monarch butterflies, and to involve thousands of students and adults in a cooperative study of the monarch's fall migration. Students involved in tagging and rearing monarchs are given the opportunity to learn hands-on science and explore migration with the help of hundreds of volunteers. The site provides tag recovery data, population dynamics, and migratory season summaries. Additional information includes a FAQ and information about butterfly rearing and the science of tagging. Monarch life history is outlined and conservation efforts are presented. A milkweed (the monarch's host plant) handbook is available online, as are several curricula that are currently being developed and refined online. There are role-playing activities, vocabulary lists, and information on butterfly life cycles. Winner, ENC Digital Dozen, September 1995. Magellan 4-Star site. (Author/DEB) ENC-002473

EnviroNet Monitoring Projects

http://earth.simmons.edu/monitoring_projects/index.html

Grades 5-12
1996
Author: developed by EnviroNet
Publisher: Department of Biology, Simmons College

Funding: National Science Foundation (NSF)

EnviroNet is a network of teachers, scientists, environmental educators, and others who use telecommunications to enhance environmental science education. It began in 1992 as a Teacher Enhancement Project at Simmons College in Boston. The purpose of the project is to enhance environmental science education in the nation's K-12 community through the use of telecommunication technology. Timetables and short descriptions are given for each project, along with detailed procedures for data collection and contact information. Entry-level participants perform simple experiments and send their raw data to the project coordinator over the Internet. Exploratory level participants perform slightly more advanced experiments and do simple data analysis using an online spreadsheet. After completing the first two levels, students can participate at the research level, where they design their own experiments, analyze the data, and send it to the project coordinator. Samples of ongoing projects include Acid Rain, which monitors pH levels for all forms of precipitation; the Plant project, which studies the biological diversity of the plant kingdom and how people of various cultures utilize plants; and the Ozone project, which uses the EcoBadge to determine local levels of ozone in parts per billion (ppb). Another project, the RoadKill program, is designed to show the diversity of animals that are killed on highways and to bring about awareness of fragmented wildlife corridors in the participant's community. Background information and templates for activity sheets are provided. Winner, ENC Digital Dozen, March 1996. (Author/LCT) ENC-004122

Turtle Trax: A Page Devoted to Marine Turtles

http://www.turtles.org/

Grade K and up

Author: Peter Bennett, Ursula Keuper-Bennett
Publisher: iComm

For anyone interested in finding out more about the marine turtle, this web site provides photographs, captured video frames, drawings, cartoons, and other information. Included are descriptions of the marine turtle, reasons why they are threatened or endangered, suggestions as to how to protect them, and an illustration of a particular group of Hawaiian green sea turtles, the Honokowai group of Maui. A page called KidzKorner contains a story, an essay by sixth grade students, student art, poems, and coloring pages, among other things. A list of books, periodicals, and videos about marine turtles is provided, as well as information about an email conference and bulletin board. Winner, ENC Digital Dozen, October 1995. Magellan 4-Star Site. (Author/RA) ENC-004042

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ThinkQuest

http://www.advanced.org/ThinkQuest/

Grades 7-12
Author: Advanced Network & Services, Inc.

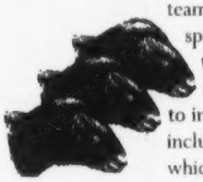
ThinkQuest is an international academic competition in which teams of students create web-based educational tools and materials that make learning fun and take advantage of the strengths of the Internet. More than $1 million is awarded annually in scholarships and cash to the winning teams, their coaches, and schools. This site provides information about the competition, a library of past ThinkQuest web entries, and a searchable database. Also included are articles, practical tips, and related links for coaches and for creating and designing web pages. Winner, ENC Digital Dozen, May 1998. (Author/LCT) ENC-012167

Hello Dolly: A Webquest

http://powayusd.sdcoe.k12.ca.us/dolly/default.htm

Grade 11 and up
Author: Keith Nuthall
Publisher: Poway Unified School District

At this web site, students can participate in an inquiry-oriented activity to learn about the implications of cloning. The site describes a scenario in which the US House of Representatives is assembling a group of specialists to investigate cloning's widespread implications for all of American society. Each team of specialists will present its findings to a special subcommittee, which will evaluate the Human Cloning Prohibition Act and determine if the bill should be expanded to include other types of cloning. The teams include the US Department of Agriculture, which will focus on the benefit of cloning on the nation's food supply; a nationally recognized group of citizens that promotes the humane treatment of animals; professors of biomedical ethics; and a pharmaceutical company committed to the advancement of pharmaceutical products using cloning. For each expert panel, the web site provides a dossier that defines both the role of the group and the tasks of each member, a list of questions to answer, an action plan for a brief presentation, and practical advice on public speaking. The site provides guidelines for brainstorming ideas, assigning tasks, and finding information on the web. Links to cloning and genetics related resources are also provided. Winner, ENC Digital Dozen, January 1998. (Author/LCT) ENC-011210



Explore the GLOBE Program

http://globe.fsl.noaa.gov/

Grades K-12
Author: Global Learning and Observations to Benefit the Environment (GLOBE) Program; GLOBE visualizations hosted by NASA's Goddard Space Flight Center
Publisher: National Oceanic and Atmospheric Administration (NOAA), Forecast Systems Laboratory and National Geophysical Data Center

Global Learning and Observations to Benefit the Environment (GLOBE) is a network of K-12 students and teachers from more than 3,000 schools in 39 countries who collaborate with research scientists to learn more about our planet. GLOBE students make a core set of environmental observations at or near their schools and report their data via the Internet. Scientists use GLOBE data in their research and provide feedback to the students to enrich their science education. Each day, images created from the GLOBE student data sets are posted on the GLOBE web site. The goals of GLOBE science and education activities are to help students reach higher levels of achievement in science and math and to increase the environmental awareness of all individuals while increasing their scientific understanding of Earth. Topics include atmospheric temperature, biometrics, cloud observations, land cover, precipitation, surface water temperature, and pH. In sample activities, students interpret satellite data, produce land-cover classification maps, and assess their landscapes for biologically important parameters. Students also collect and analyze data on atmospheric composition and trace gases and make observations about clouds, temperature, and precipitation. In another activity, they measure ultraviolet radiation using a photochemical dosimeter. Winner, ENC Digital Dozen, September 1995, November 1996, May 1998. (Author/LCT) ENC-009304

Global SchoolNet's Internet Projects Registry

http://www.gsn.org/pr/index.cfm

Grades K-12
Author: Paris Treantafeles, web developer; developed by Global SchoolNet
Publisher: Global SchoolNet Foundation (GSN)

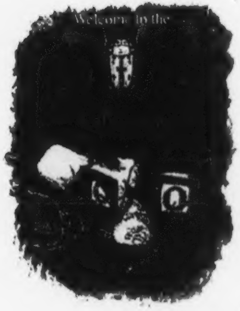
The Global SchoolNet Foundation (GSN) maintains this site to provide teachers with lists of appropriate online projects to integrate into their required coursework. These projects may be from any K-12 subject area or related activity and are listed by the month in which they begin. The site provides summaries of the projects, contact information, and links to some ongoing projects. Currently listed projects include SEICHO (Student Environmental Internet CHallenge Operation, a six-hour, real-time Youth Environmental Online Summit); Mouse Trap Powered Vehicle (a competition for science classes); Where on the Globe Is Roger? (adventures of world traveler Roger Williams and his truck Bubba); and Shapes Around the World (a commercially sponsored project to allow students to research geometry online). Projects that require email correspondence include The Great Canadian Trivia Contest Question; the Global Language Project (designed by grade 5-8 teachers to introduce their students to the languages and cultures of the world); and the German Cultural Exchange (students join their German counterparts in discussions of issues common to them in both English and German). Teachers are encouraged to list their own Internet projects. Other resources linked to this page include a directory of schools using CU SeeMe desktop videoconferencing; updates on projects, events, and opportunities available through GSN; and announcements about contests, conferences, and educational K-12 web sites. Winner, ENC Digital Dozen, July 1996. (Author/GMM) ENC-002006

Insect Zoo

http://www.naturalpartners.org/InsectZoo/

Grades 4-8
Author: Cissy Anklam and R. Dan Brook
Publisher: University of Mississippi

The Insect Zoo is a textual and virtual tour of the O. Orkin Insect Zoo. An interactive map shows the layout of the actual Insect Zoo at the Smithsonian's National Museum of Natural History. When visitors click on specific locations on the map, they see pictures of the exhibits at the O. Orkin Insect Zoo. Images of organisms can be rotated 360 degrees and sounds from the rain forest can be heard. The site also features a curriculum module that integrates the study of insects with math, literature, social studies, and art. The module contains 26 interdisciplinary activities and links to sites that give teachers resources and information about the organisms. The module's primary emphasis is on Class Hexapoda, but spiders from Class Arachnida are also covered. The activities contain teacher objectives, materials, and procedures, and use arthropods as a means to bring science into the classroom. In one activity, students integrate math, science, and art when they study the work of M.C. Escher and make tessellation puzzles out of pictures of insects cut into geometric shapes. Teachers can read how the activities correspond to the national science standards. The site includes a glossary, bibliography, and links to related web sites. Visitors can also exchange ideas with the scientists at the Smithsonian Institute. (Author/JR) ENC-015378

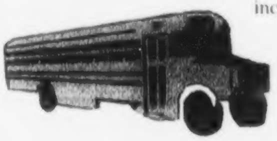


The Virtual Field Trips Site

http://www.field-guides.com/

Grades K-12
Author: Tramline, Inc

The virtual field trips on this site allow students to visit a variety of hard-to-reach places, ranging from the inside of a volcano to the eye of a hurricane. Additional destinations include deserts, salt marshes, and the underwater world of sharks, as well as a tour of the world's seven natural wonders. Each trip comprises a number of stops, or web sites, with specific information. For example, as students take the desert tour, they visit selected pages from desert research institutes, travel agencies, and national parks. The Field Guide Player increases the speed of a trip by automatically caching the sites to be visited; it also simplifies navigation by using a very basic web navigator. The player has a window that displays text describing the site, asks questions, or provides other kinds of information students might need. Teacher's resources include a set of student worksheets for each field trip, as well as short teacher's guides and links that provide background or curriculum guidance on each field trip. Winner, ENC Digital Dozen, October 1998. (Author/LCT) ENC-013215



NGS Kids Network

NGS Works

Grades 3-9
1998
Author: National Geographic Society

Developed by the National Geographic Society (NGS) Kids Network, this CD-ROM contains a suite of data analysis, word processing, and telecommunications software designed specifically for grades 3 to 9. The NGS Kids Network is a telecommunications-based, interdisciplinary curriculum in which students collaborate as research scientists by conducting original research. Students use the software to exchange information via email, collect and graph data, and display software-generated maps. The program components include a simple spreadsheet program, a graphing tool, and a collection of National Geographic maps that students can use to plot data points and correlate their data with geographic locations. It also contains a word processor, a set of clip art images, and a paint tool, as well as a calendar and telecommunications software that connects

Ordering Information:
National Geographic Society
Online Store
Educational Services
PO Box 11303
Des Moines, IA 50340
Fax: (515) 362-3345
Toll-free: (800) 437-5521
http://www.nationalgeographic.com/main.html

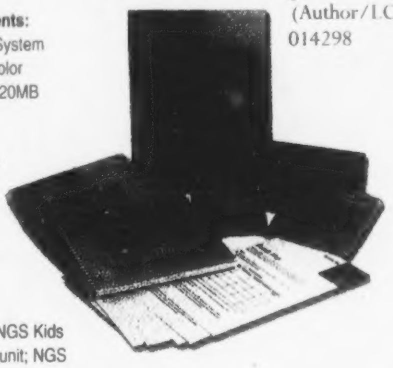
$199.00 per CD-ROM package
Order # U90601
Note: Multi-user and site licensing also available. Contact vendor for further information.

System Requirements:
Macintosh: 68040; System 7.0 or higher; 256-color display; 8MB RAM; 20MB hard disk space

Windows: 386DX or higher; Windows 3.1 or higher; 256-color display; 8MB RAM; 20MB hard disk space

You will also need: NGS Kids Network curriculum unit; NGS Kids Network tuition membership; NGS Kids Network test kit (as required); and an Internet connection. Contact vendor for further information.

students to the NGS Kids Network server. The CD-ROM is accompanied by a software manual, an activity book, and a set of reproducible worksheets. The manual provides general instructions for installing and navigating the software, as well as instructions for each of the eight software components. The activity book is divided into two sections: the first provides cross-curricular activities for grades 3 to 6, and the second features data analysis activities for middle school students. For each activity, the book provides time and classroom management tips for teachers, a summary of learning goals, and instructions for advance preparation and for carrying out the activity in class. It also provides discussion questions, homework assignments, and rubrics for assessing student learning. (Author/LCT) ENC 014298



Teach with Databases Series

Toxics Release Inventory

Grades 9-12
1998
Author: CD-ROM and user's manual by the United States Environmental Protection Agency

Ordering Information:
National Science Teachers Association (NSTA)
The Science Store
1840 Wilson Boulevard
Arlington, VA 22201-3000
Telephone: (703) 243-7100
Fax: (703) 522-6091
Toll-free: (800) 722-6782
science.scope@nsta.org
http://www.nsta.org/

$35.00 per kit
Order # PB143X01

System Requirements:
DOS: 386 or higher; 640K RAM (with 510K available for fielded data); hard disk with at least 1.5MB free space; CD-ROM drive with CD-ROM extensions; MS-DOS or PC-DOS version 3.3 or higher

The information and activities in this kit give students the opportunity to use real-world environmental data. Two teacher's manuals contain activities to help students learn how to use data and databases. Lesson plans are provided with reproducible student sheets, answer keys, and activity management information. One manual, *Database Basics*, uses situations with which students are familiar as the data source for collection, analysis, and display. In one activity, for example, students use a table containing the prices of various frozen dairy desserts at a Los Angeles supermarket to calculate the mean, median, and mode of the prices. The activities in the other teacher's manual, *Toxic Release Inventory*, help students research environmental issues associated with toxic releases in their own communities. The data they use are either gathered in experiments the students perform themselves or found in the EPA's toxic release inventory database. In a sample activity, students measure the effect of temperature on the amount of dissolved oxygen in water collected from three sites in their community. The CD-ROM in the kit contains the EPA's toxic release inventory database, which is also available on the Internet. A user's manual explains how to maneuver in the database to access the information. The appendices contain EPA chemical information forms, descriptions of the items in the database, and sources for further assistance. Another book in the kit, *Getting Started*, provides a collection of stories about teachers who initiated environmental programs in their schools. Each unit in this book contains general information about how to bring environmental education into the classroom, a list of sample sources, and a collection of stories meant to inspire other teachers. Finally, the *Guide to Environmental Issues* contains information about environmental protection issues, complete with frequently asked questions and answers. A glossary contains terms associated with environmental issues, and lists of environmental laws and governmental agencies are included. (Author/JSR) ENC-014582

Toxics Release INVENTORY
Getting Started

Connected Questions Series

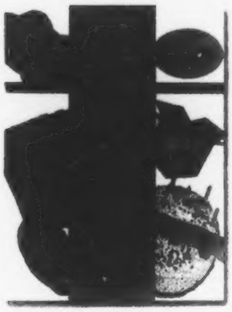
Which Would You Miss Most...

Grades 4-9
1998
Author: Ricki Wortzman, Julie Brodie; editor, Saran Johnson; illustrators, Rob Blackard, Miguel Villasenor

Ordering Information:
Classroom Connect Inc.
431 Madrid Avenue
Torrance, CA 90501
Telephone: (310) 618-0109
Fax: (888) 801-8299
Toll-free: (800) 638-1639
connect@classroom.com
http://www.classroom.com/

$59.95 per book
Order # QUE-1030-C182

The interdisciplinary unit in this teacher's guide engages students in Internet research projects about hearing and vision, holidays, and the environmental impact of using paper or plastic. It is part of the Connected Questions series, which combines a student-centered approach with activities that focus on the acquisition of skills that students will need to be successful in the twenty-first century. Other goals include promoting the effective use of the Internet as a tool for research, communication and problem solving, and giving students the opportunity to investigate meaningful questions in an environment of intellectual collaboration. Each unit in the series poses three central questions as basis for a five- to six-week Internet project and offers a three-step framework for student investigation and research that includes Question, Research, and Analysis. This unit poses three questions: Which would you miss most: Birthdays or holidays? Paper or plastic? and Your eyes or your ears? Each topic opens with a brainstorming session in which students generate more questions and organize their questions into concept maps. In the Research phase, student teams choose a specific topic to investigate. Sample topics might include recycling and deforestation, national and religious holidays, and assistive technology. Students then expand their concept map and use it to organize their questions and develop a path to follow in their research. The activities in the teacher's guide help students organize effective Internet searches, examine Internet sites critically, and report their findings to the class. After students have finished their research, they begin the Analysis phase in which they summarize and apply what they have learned. The teacher's guide provides background information about Internet safety and search strategies, sample concept maps and rubrics, and ideas for classroom activities. In sample activities, students analyze the waste and trash left over after lunch and plan a lunch that generates less waste and trash; gather some statistics about birthdays; and conduct some simple experiments in visual perception. The teacher's guide also provides bibliographic references to books and electronic sources. The Connected Questions web site provides access to a searchable database with links to related topics; an online bulletin board allowing students to pose and respond to questions from kids across the country; and an online teacher's lounge where teachers can share ideas and insights with other educators. (Author/LCT) ENC-014018



The Virtual Cell Web Page

http://personal.tmlp.com/Jimr57/

Grade 10 and up
Author:project leader/model development coordinator, Jim Rusconi; webmaster, Charles Berube

Visitors to this site can go on a tour of a virtual cell and virtual textbook. The virtual cell has three-dimensional color drawings of the cell and the organelles. When a visitor clicks on an organelle in the cell, textual information appears next to an enlarged drawing of it. Many of the organelles can have their outer membranes cut off or be dismantled to show their interior structures. The image can be rotated left or right and zoomed in and out with navigation buttons. The text explains the function of the organelles and any special information related to them. For example, the mitochondrion can be seen with its outer membrane cut off first and then with the inner membrane removed. The text that accompanies the diagrams explains that cell respiration takes place in the mitochondrion, the inner membrane is where the aerobic reactions take place, and the mitochondria are believed to have evolved from prokaryotes because they have their own DNA. The Virtual Textbook, which is a work in progress, contains color animated drawings to illustrate the concepts within the online chapters. Hyperlinks connect visitors to specific subjects within each chapter. Chapters are planned in biology, chemistry, physics, and math. WInner, ENC Digital Dozen, April 1999. (Author/JSR) ENC-014670

Kit & Kaboodle

http://www.kitkaboodle.org/

Grades K-6
Author: CompuQuest, Inc.

In this web-based enrichment curriculum, students learn how to use the Internet as a source of science information. The curriculum begins with a series of activities designed to help teachers and their students develop basic Internet skills, such as navigating and searching the web, sending electronic mail, and using CyberPad, an on-site web editing tool. Once students have earned their Internet user's certificate, they progress to the science modules. In a sample activity, students visit an online alien zoo where they observe and classify aliens, choose an alien to write about, and email their report to the teacher. They also conduct a webquest for information about sharks and develop a class site where they can publish their work. Teacher resources include a skills assessment checklist, an annotated bibliography of children's books, and an explanation of the science process skills children are learning. Teachers can also print out masters for activity sheets, take-home activities, and letters to parents. Additional features include small-group chat rooms and a Web Cafe for teachers. Winner, ENC Digital Dozen, December 1998. (Author/LCT) ENC-013911

Planet Earth: A Suite of Interactive Learning Activities on Ecology

http://powayusd.sdcoe.k12.ca.us/teaching_learning/mt%26r/PlanetEarthMainPage.htm

Grades 5-9
Author: project design, Keith Nuthall

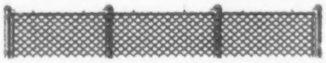
The first activity at this web site, The Earth's Treasures, is an enhanced fill-in-the-blank quiz about environmental issues. Students click on links to find images and other clues to help them find the answers. As they work through each paragraph, students are asked to identify treasures in their own community, describe how they are connected to animals, and think about what they can do to help the environment. Upon submitting their answers, students receive a completed page that can be turned in to the teacher. Another activity, You Make a Difference, provides links and open-ended questions that focus on a single environmental issue, such as habitat destruction. Students use the information to produce a television, radio, newspaper or Internet public service announcement. The final activity, Conflict Yellowstone Wolves, is a webquest that challenges students to develop a solution to the heated debate on reintroducing wolves into Yellowstone National Park. The site also provides an Ecology Hot List of links that support ecology curriculum. A teacher's toolkit is provided to help teachers download the required Internet plug-ins. Winner, ENC Digital Dozen, August 1998. (Author/LCT) ENC-012554

Prisoners or Protected? A Webquest Exploring the Humanity of Zoos

http://www.richmond.edu/~ed344/webquests/zoos/

Grades 5-8
Author: Cathy Shulof, Maggie Gordon, Beverly Connolly
Publisher: University of Richmond, Education Department

In this webquest, children are encouraged to think about some important yet controversial issues surrounding zoos, such as animal rights. Students look at different sides of the issue to determine whether zoos can be humane to animals. Each student is assigned to a group and a role. Every student is responsible for reading the core readings. Then, each student reads the articles that correspond to his or her role and answers questions in a group discussion. The students also design a zoo that takes all opinions into account and is a healthy and happy place for animals. In addition to articles and links, the site provides a glossary, text and electronic resources, and a teacher's page. The teacher's page contains suggestions for using cooperative learning, tips for classroom management, and extension questions. Winner, ENC Digital Dozen, July 1998. (Author/LCT) ENC-012499



Active Mind Series

Logical Journey of the Zoombinis

Grades 3-7
1996
Author: product concept and design, Chris Hancock, Scot Osterwell
Publisher: Broderbund Software, Inc.

Ordering Information:
The Learning Company
School Division Orders
One Athenaeum Street
Cambridge, MA 02142
Telephone: (612) 494-1200
Fax: (612) 494-5700
Toll-free: (800) 761-1348
http://www.learningco.com/

$59.95 per CD-ROM package

Standards: NCTM Curriculum and Evaluation Standards (1989)

System Requirements:
Windows: 33 MHz 486SX or faster; 8MB RAM and 2 MB hard disk space; 2x CD-ROM drive; Windows 3.1 or higher; MS/PC DOS 5.0 or higher with Windows 3.1; SuperVGA; sound device

Macintosh: 25MHz 68030; 8-bit video support; 640x480 256-color display; 1MB hard disk space available; 8MB RAM; 2x CD-ROM drive; System 7.0.1 or higher

The 12 interactive activities on this CD-ROM are designed to help students explore and apply fundamental principles of logic, problem solving, and data analysis in an adventure story context. The Active Mind series offers a selection of children's CD-ROMs that contain mathematical skill-building activities with progressive levels of difficulty. On this CD-ROM, players guide bands of small creatures, named Zoombinis, on their escape to a new homeland. Each open-ended activity has many possible solutions and challenges students to use logical reasoning skills to outwit Tree Trolls and other threatening creatures. The mathematical content is based on the attributes of the Zoombini characters (variations in hair, eyes, nose, and feet) that serve as variables and are the basis for decision making. For example, in an activity called Allergy Cliffs, there are two bridges spanning the cliffs. One bridge will only allow Zoombinis with a particular attribute—such as a red nose—to cross, while the other bridge accepts all other Zoombinis. Players must use a sorting process to determine which bridge will allow each creature to cross before both bridges break. The teacher's guide contains classroom activities, with blackline masters, to develop and extend the concepts presented on the CD-ROM. Also found are annotated lists of educational resources for children, parents, and teachers along with a user's guide for the CD-ROM. All activities reflect the NCTM standards. See article on page 23. (Author/JRS) ENC-014513

Logical Journey
of the Zoombinis

Active Mind Series

Math Workshop Deluxe

Grades K-6
1997
Author: CD-ROM, Broderbund Software, Inc.; editors, Seth Jacobson, Sioban Scanlon
Publisher: Broderbund Software, Inc.

Ordering Information:
The Learning Company
School Division Orders
One Athenaeum Street
Cambridge, MA 02142
Telephone: (612) 494-1200
Fax: (612) 494-5700
Toll-free: (800) 761-1348
http://www.learningco.com/

$59.95 per CD-ROM

Standards: NCTM Curriculum and Evaluation Standards (1989)

System Requirements:
see record on page 66

In this CD-ROM, part of the series described on page 66, middle-school math whiz Poly Gonzales leads students around an animated workshop control room in eight interactive mathematics activities. Students click icons that lead to activities such as Bowling for Numbers, in which they answer 10 math questions to help Gus the Gorilla bowl a strike and earn points toward putting the students' names in the Bowling Hall of Fame. In this game, students choose sets of questions to test their knowledge of mathematical operations, fraction equivalency, and estimation. The teacher's guide contains 19 lesson plans with activity sheets to extend the concepts in the program. It also includes mathematical applications to art, language arts, and music. Also found are annotated lists of related books, games, and Internet sites, and a user's guide with parent information. Winner, Technology & Learning Award of Excellence. (Author/JRS) ENC-013950

MATH
WORKSHOP

Hot Dog Stand: The Works

Grades 5-12
1996
Author: Sunburst Communications, Inc.

The student becomes a manager of a hot dog stand in an interactive, multimedia environment. Users must compare suppliers' rates, research historical sales, and watch weather forecasts to decide how many hot dogs, buns, chips, and other supplies to order in anticipation of a variety of sporting events and concerts; students must also set prices for each item. Three levels from basic to advanced are available. At the intermediate and advanced levels, students are challenged with unforeseen circumstances such as refrigerator disrepair and grill breakdowns that require precious capital to fix—but if ignored, lead eventually to total equipment failure. Students are given calculators and estimator tools to aid in supplying the stand. A book of hot dog jokes, a set of recipes, and a puzzle are included as small diversions from the stressful job of managing the business of the hot dog stand. The teacher's guide includes supporting activities such as figuring the total cost of someone's order, research projects about business and management, and setting up a classroom business. Teacher options allow the teacher to preset the level of difficulty and to manage multiple users. EDDIE Awards, 1997. (Author/RMK) ENC-013289

Ordering Information:
Sunburst Communications, Inc.
101 Castleton Street
PO Box 100
Pleasantville, NY 10570
Telephone: (914) 747-3310
Fax: (914) 747-4109
Toll-free: (800) 321-7511
service@nysunburst.com
http://www.sunburstonline.com/

$89.95 per CD-ROM (Macintosh/Windows)
Order # 6599HG
Note: Lab packs and site licensing also available. Please contact vendor for more information.

System Requirements:
Windows: 486 with 66 MHz or better; 8MB RAM; 1MB free hard drive space; Windows 3.1 or 95; 2x CD-ROM drive; 640x480 256-color display

Macintosh: 68030 with 25 MHz or better (68040 recommended); 8MB RAM; System 7.0 or higher; 2x CD-ROM drive; 640x480 256-color display

HOT DOG
STAND

The Factory Deluxe: Strategies in Problem Solvi

Grades 4-8
1998
Author: CD-ROM design, Paul Kronmeyer, Jennabeth Bogard, Jennifer Simon, Joe Summerhays, John Mullaney, Frank Migliorelli

Ordering Information:
Sunburst Communications, Inc.
101 Castleton Street
PO Box 100
Pleasantville, NY 10570
Telephone: (914) 747-3310
Fax: (914) 747-4109
Toll-free: (800) 321-7511
service@nysunburst.com
http://www.sunburstonline.com/

$89.95 per software package (hybrid) or 5 lab pack
Order # 8341HG

The five factory-based activities on this CD-ROM are designed to help students expand their problem-solving strategies in geometry, sequencing, and spatial sense. Players learn how to use three types of machines in an assembly line setting: one that places punch marks and stripes on a geometric shape, one that cuts away part of a shape, and one that rotates a shape. In the activities, individual students experiment with researching, designing, and building products using different combinations of the machines. Then, in the shipping phase of the program, students use spatial ability to place orders in the properly shaped

System Requirements:
Macintosh: 68040 or better; 25 mHz; System 7.0 or higher; 8MB RAM; 640x480 256-color display; 4x CD-ROM

Windows: IBM or compatible computer; Windows 3.1 or 95; 486 or better; 66Mhz; 8MB RAM; 640x480 256-color display; 4x CD-ROM

crate. In the delivery phase, students practice skills with area formulas, estimation, and computation as they compete to be the first to deliver their product. A journal option allows students to save pictures of selected products and to record observations. Teachers can customize software to meet student needs and to keep records to chart student progress. The accompanying teacher's guide provides information about the program and overviews of the activities. Codie Award Finalist, 1998. (Author/JRS)
ENC-011765

Green Globs and Graphing Equations

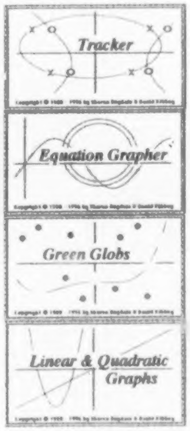
Grades 5-12
1997
Author: Sharon Dugdale, David Kibbey

Ordering Information:
Sunburst Communications, Inc.
101 Castleton Street
PO Box 100
Pleasantville, NY 10570
Telephone: (914) 747-3310
Fax: (914) 747-4109
Toll-free: (800) 321-7511
service@nysunburst.com
http://www.sunburstonline.com/

$99.95 per software package (Windows)
Order # 6984HG
Note: Software is also available for Macintosh, DOS, and Apple. Lab packs and site licenses are available. Contact publisher for more information.

Funding: National Science Foundation

The focus of this computer program and teacher's guide is on the relationship between equations and their graphs. The program has four sections, the first of which plots the graphs of entered equations. In another section, graphs of certain types (line, parabola, circle, ellipse, hyperbola) are displayed and students enter equations that match the graphs. There are also two games. In one game, Green Globs, 13 green dots are randomly placed on a grid and students try to enter equations that pass through as many of the dots—green globs—as possible. In the other game, graphs are hidden on a grid and students determine their equations by using horizontal and vertical lines to find the location of the graphs. Each point where the line crosses the hidden graph is marked on the screen. After locating the graph, students enter its equation. The teacher's guide provides the program description for each section, ideas for classroom use, and student materials.
(Author/VN/JRS)
ENC-013633



Science Court Series

Statistics

Grades 4-6
1997
Author: Tom Snyder and David Dockterman
Ordering Information:
Tom Snyder Productions, Inc.
80 Coolidge Hill Rd
Watertown, MA 02172-2817
Fax: (617) 926-6222
Toll-free: (800) 342-0236
http://www.teachtsp.com/

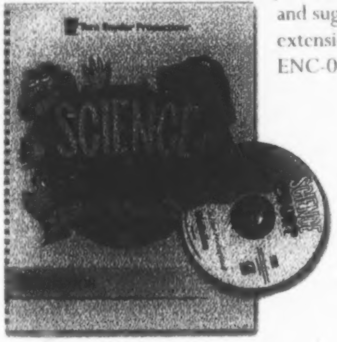
$59.95 per CD-ROM
Order # STA-D
Note: Additional ordering options available.

$29.95 per kit
Order # STAK-D

System Requirements:
Macintosh: 68040 or higher, System 7.1 or later; 8MB RAM; 640x480 256-color display

Windows: 486 or higher; Windows 3.1 or Windows 95; 8MB RAM sound card; 640x480 256-color display

Students participate in an animated courtroom drama in which they evaluate the validity of data and draw conclusions. The Science Court CD-ROMs mix courtroom drama, student activities, and humor to teach fundamental concepts of science and model good scientific practice. Each CD is designed to take up two to three class periods and to promote teamwork, collaboration, and communication. In this CD-ROM, Jen Betters, courtroom correspondent, leads students through a humorous courtroom trial that investigates whether there is a relationship between the increase in the number of left-handed people and the increase in the number of UFO sightings. The trial, divided into four parts, is used to introduce the concepts of data, variable, random sample, and biased study. At the end of each part, students break into cooperative teams and answer questions from the information sheets reproduced from the teacher's guide. They also do a related hands-on activity, such as recording the results of jelly bean sampling, to help understand the statistical concepts. The teacher's guide includes learning objectives, detailed lesson plans, assessment materials, and suggestions for lesson extensions. (Author/JRS)
ENC-011702



Tabletop Jr.

Grades 3-6
1995
Author: TERC, Inc.; project director, Chris Hancock
Publisher: Broderbund Software, Inc.

As they create unusual creatures and objects, students are introduced to basic mathematics concepts, including data visualization, grouping and sorting, classifying, graphing, interpreting data, and logical reasoning. For instance, students may create the Snoods, characters whose variables are their physical characteristics (type of hair, eyes, nose, feet). Players may also create pizzas, using any combination of toppings to learn sorting and classifying skills. Students

Ordering Information:
The Learning Company
School Division Orders
One Athenaeum Street
Cambridge, MA 02142
Telephone: (612) 494-1200
Fax: (612) 494-5700
Toll-free: (800) 761-1348
http://www.learningco.com/

$99.95 per software package (Macintosh/Windows)
Note: Only available in combined packaging with Tabletop Sr. Please specify platform.

Standards: NCTM Curriculum and Evaluation Standards (1989)

Funding: Jostens Learning Corporation; Broderbund Software, Inc.; National Science Foundation (NSF)

System Requirements:
Windows: Windows 3.1 or higher; 3.5" floppy drive; VGA monitor

Macintosh: 2 MB RAM; 3.5" floppy drive; System 7.0 or higher.

can sort their Snoods, pizzas, or other objects in seven ways: free form, bunched by attributes, stacked by attributes, axes (scatter plot and cross tab graphs), loops (Venn diagrams), linked by their like characteristics (chains), or in grid formation (tiling). The teacher's manual includes lesson plans that may function as a single lesson or as part of open-ended investigations. It also includes more than 50 illustrated challenge cards of varying difficulty, each with a game or puzzle that may be solved using the program or physical manipulatives. (EPIE Institute/RMK) ENC-005157

TABLETOP JR.
TABLETOP JR.

The Geometric SuperSUPPOSER

Grades 6-12
1993
Author: developed by Judah L. Schwartz and Michal Yerushalmy

Ordering Information:
Sunburst Communications, Inc.
101 Castleton Street
PO Box 100
Pleasantville, NY 10570
Telephone: (914) 747-3310
Fax: (914) 747-4109
Toll-free: (800) 321-7511
service@nysunburst.com
http://www.sunburstonline.com/

$99.95 per software package or 5 lab pack
Order # 4004HG (DOS)
Order # 6532HG (Macintosh)

System Requirements:
Macintosh: Mac Plus with an 800 K drive; 1 MB RAM; System 6.07 or higher; color monitor recommended

DOS: IBM/Tandy 1000 version or compatible; color monitor and color graphics adapter (EGA or VGA recommended) DOS 3.3 or higher; mouse optional

This software and teacher's guide are designed to encourage students to draw, study, explore, construct, and solve geometry problems. The Shape menu allows a user to generate a random shape or to create a shape on which to carry out a construction. This shape then serves as the basis for the draw operations, the measurements, and other manipulative operations. Using the Draw menu, users can add constructions such as lines, segments, perpendiculars, and bisectors to the basic shape selected from the Shape menu. Students may also translate, rotate, reflect, and invert their shape. The Label menu contains features for subdividing, labeling intersections, generating points, and defining and automatically labeling points. Using the Measure menu, students can measure various components of their construction, including angles, lengths, and areas. The Repeat menu enables students to apply the constructions and measurements performed on a previous shape to a new shape of the same general category. The software uses windows to display the most recent constructions on the same primitive shape and contains a geometer's spreadsheet tool that lets students conjecture using data from the present and previous cases. A function feature allows students to define any set of constructions that they may then execute on a given shape; functions may be saved. The teacher's guide describes each menu at length, provides a tutorial for working with the software, and suggests activities for using the software in the classroom. It also discusses questioning and discussion strategies, teaching modes (single computer, multiple computers, or group projects), and ideas about geometric shapes. Eight inquiry problems are included, along with the technical, pedagogical, and mathematical details needed to carry out each activity. (AM/RMK) ENC-013545

Fraction Attraction

Grades 3-8
1997

Ordering Information:
Sunburst Communications, Inc.
101 Castleton Street
PO Box 100
Pleasantville, NY 10570
Telephone: (914) 747-3310
Fax: (914) 747-4109
Toll-free: (800) 321-7511
service@nysunburst.com
http://www.sunburstonline.com/

$79.95 per Macintosh/Windows CD-ROM and teacher's guide
Order # 6886HG
Note: Lab packs and site licensing are also available. Please contact vendor for further information.

Standards: NCTM Curriculum and Evaluation Standards (1989)

System Requirements:
Windows: 486 with 66 MHz or better; 8MB RAM; 13MB free hard drive space; Windows 3.1 or 95; CD-ROM drive; sound card; 640x480 256-color display

Macintosh: 68030 with 25 MHz or better; 8MB RAM; 8MB hard drive space; System 7.0 or higher; CD-ROM drive; 640x480 256-color display

Gilda the Gator guides students through a fairgrounds of games that test understanding of fractions, decimals, and percents, as well as students' sense of the relative sizes of fractions with different denominators. There are four games at the fairgrounds, each of which can be set to different levels of difficulty. In the Frac Track, students use fractions to match up four jockeys with their horses in the order in which they placed in a race. At the Frac O Wheel, students must unload the Ferris Wheel by determining the fraction and direction in which to turn the wheel. Adjusting the level of difficulty changes the number of carts and the denominators of the fractions. In Fuzzy Fracs, students knock over fuzzy creatures in the order determined by the fractions shown on their chests. Whack A Frac is a timed game requiring students to whack all gophers bearing an equivalent representation of the target quantity. For each game, students can push a button to get an analysis of their mistakes. Also, Gilda the Gator is always available if they need help. The teacher's guide contains extension activity worksheets and implementation guides. Winner, KIDS FIRST! Award, 1997. (Author/RMK) ENC-013377

FRACTION
ATTRACTION

The Graph Club with Fizz & Martina

Grades K-4
1998
Author: designed by Peggy Healy Stearns

Ordering Information:
Tom Snyder Productions, Inc.
80 Coolidge Hill Rd
Watertown, MA 02172-2817
Fax: (617) 926-6222
Toll-free: (800) 342-0236
http://www.teachtsp.com/

$79.95 per CD-ROM package
Order # J-GRT
Note: Network versions and site licensing also available in English or bilingual (English/Spanish) editions. Specify computer type and disk or CD-ROM.

$59.95 per curriculum kit
Order # J-GRK
Note: Includes template disk of graphing activities; activities guide; 28 student workbooks; and Fizz & Martina's incredible not-for-profit pet resort mystery chapter book. Does not include Graph club software.

Standards: NCTM Curriculum and Evaluation Standards (1989)

System Requirements:
Windows: 286/33 or higher; Windows 3.1 or later; 4MB RAM; VGA or better monitor; sound card; CD-ROM drive

Macintosh: Macintosh LC II (68030 processor) or higher; System 6.0.7 or later; 1MB RAM; CD-ROM drive

This program is intended to assist students in making the transition from graphing with manipulatives to graphing in the abstract. It also seeks to develop understanding of the relationship between different representations of the same data; for example, picture graph, bar graph, line graph, circle graph, and table. Correlated to NCTM standards, the program encourages cooperative learning, problem solving, and cross-curricular integration. Students learn that data come from many sources and are used for a variety of purposes. They can collect information, answer questions, make decisions, and solve problems. Sample graphs are included with the software for exploring and/or matching. In the Explore mode of the program, students may generate a pair of graphs that permit exploration of graphing in an open-ended environment. The Match mode generates a random graph and challenges students to create a different type of graph to represent the same data. The Create mode permits students to enter collected data for graphing, while the Guess mode encourages critical thinking skills and demonstrates that there are often many good answers to a question. Other options allow students to label and even write about their graphs in a text box. The teacher's guide includes blackline masters of sample graphs and activities as well as suggestions for how to introduce and assess graphing concepts and activities in the primary grades. Winner, Technology & Learning Award of Excellence. (Author/LDR/GMM) ENC-014421

Tom Snyder Productions
THE GRAPH CLUB
with Fizz & Martina

Sunbuddy Math Playhouse

Grades K-4
1997
Author: Sunburst Communications, Inc.

Ordering Information:
Sunburst Communications, Inc.
101 Castleton Street
PO Box 100
Pleasantville, NY 10570
Telephone: (914) 747-3310
Fax: (914) 747-4109
Toll-free: (800) 321-7511
service@nysunburst.com
http://www.sunburstonline.com/

$79.95 per CD-ROM package
Order # 6835HG
Note: Lab packs and site licensing available. Contact vendor for further information.

System Requirements:
Windows: 486/66 DX2 or better; 8MB RAM; 16 MB free hard drive space; Windows 3.1 or higher; 2x CD-ROM drive (4x recommended); sound card; SVGA graphics card for 640x480 256-color display

Macintosh: 68040 or better CPU; 5.5MB RAM free; System 7.0 or higher; 2x CD-ROM drive (4x recommended); 640x480 256-color display

In this interactive theater environment, students can choose to watch a play while reading along, to click on animated presentations of mathematical facts, or to play mathematical games. The play is a story about Tiny the Elephant who leaves the circus in search of a career in music. Along the road to Bremen, where he hopes to find fame, he runs into various other animals that decide to join his band. At various points in the story, students are told about solos, duets, and trios, counting by fives, the number of hours in one day, and other mathematical snippets related to the story. Students discover these snippets by clicking on rocks, clouds, trees, etc. to reveal the hidden information. Students can venture backstage at any point and play one of four mathematical games: a memory game, a map game, an addition and subtraction game, and a sorting game. In the sorting game, students must sort instruments by color and type. The map game asks students to move along a city grid by following directions given according to the four cardinal points. All of the games can be played at three levels of difficulty. The teacher's guide includes descriptions of each of the screens and activities and also provides ideas for extension activities. The guide provides a script so that students can act out scenes involving the playhouse characters, sing-along sheets for the children, and instructions for implementing small group lessons with the CD-ROM. Winner, National Educational Media Network Gold Apple, 1998. EDDIE Award, 1997. (Author/RMK) ENC-013356

SUNBUDDY MATH PLAYHOUSE

Science Court Series

Water Cycle

Grades 4-6
1997
Author: Tom Snyder, David Dockterman, Bob Thibeault, Eytan Bernet, Richard Abrams, Kent Publishing Services, Inc.

Ordering Information:
Tom Snyder Productions, Inc.
80 Coolidge Hill Road
Watertown, MA 02172-2817
Fax: (617) 926-6222
Toll-free: (800) 342-0236
http://www.teachtsp.com/

$59.95 per CD-ROM package
Order # WAT
Note: Contact publisher for more information.

System Requirements:
Macintosh: 68040 or higher; System 7.1 or later; 8MB RAM; 640x480 256-color display

Windows: 486 or higher; Windows 3.1 or Windows 95; 8MB RAM sound card; 640x480 256-color display

In this CD-ROM, part of the series described on page 68, courtroom correspondent Jen Betters leads students through a trial that investigates the charge that the water on the subway station floor is from leaky water pipes rather than from condensation. The four parts of the trial investigate the water cycle, condensation, evaporation, and states of matter. A sample activity involves the students in investigating how the size of a container opening affects the rate of evaporation. The accompanying poster illustrates important ideas from the trial and suggests four additional experiments related to the water cycle. (Author/JRS)
ENC-011901

Thinkin' Science Series

Thinkin' Science Zap!

Grades 3-6
1998
Author: Edmark Corporation

Ordering Information:
Edmark Corporation
PO Box 97021
Redmond, WA 98073
Fax: (425) 556-8430
Toll-free: (800) 691-2986
edmarkteam@edmark.com
http://www.edmark.com/

$59.95 per CD-ROM package (Macintosh/Windows)
Order # 802-0721
Note: Lab packs and site licensing available. Contact vendor for further information.

System Requirements:
Windows: 486, Pentium or better, 66 MHz or faster; 8MB RAM; 5MB hard drive space; Windows 3.1, Windows 95 or higher; 2x CD-ROM drive; sound card; 640x480 256-color display

Macintosh: 68040 or PowerPC; 8MB RAM, 16MB with PowerPC; System 7.0.1 or later; 640x480 256-color display; 2x CD-ROM drive

At this virtual laboratory, students can experiment with optics, sound, and electric circuits. Players act as Guest Directors at a rock concert for artists Blaze, Riff, and Surge; their role is to control the light and sound system. However, lightning has just struck the theater, and the control systems have gone haywire. Electrons are leaking from open circuits, and the light and sound systems also need repair. Students follow each character into his or her laboratory to learn how to fix the equipment and earn the components that they will use to repair the lightning damage. The Laser Light Lab features a virtual laser table where students manipulate a variety of lenses, mirrors, filters, and barriers to reflect, refract, and absorb light. In the SoundWave Studio, students see, hear, and control sound waves to make Boogiebots dance to a particular frequency or amplitude. In Surge's Electroloft, users tinker with batteries and light bulbs, wires and switches, and conductors and insulators to connect a variety of gadgets in series and parallel circuits. They also repair existing circuits by changing the battery terminals, locating short circuits, and removing nonconducting materials. Each laboratory features a tutorial mode as well as a free exploration mode. As students progress through the tutorials, they advance along a color-coded Grow Slide to more challenging problems. Additional science content information is provided in an online encyclopedia that contains more than 200 articles written especially for children. Once students have collected their components, they use what they have learned to create their own multimedia concert with colored lights, sound effects, and other electrical wizardry. (Author/LCT)
ENC-013504

EDMARK
ZAP
The Science of Light, Sound and Electricity

Thinkin' Science

Grades 1, 2
1997
Author: Edmark Corporation

Ordering Information:
Edmark Corporation
PO Box 97021
Redmond, WA 98073
edmarkteam@edmark.com
Fax: (425) 556-8430
Toll-free: (800) 691-2986
http://www.edmark.com/

$59.95 per CD-ROM package, school version

Children can use this CD to develop observation skills and explore fundamental science concepts in physics, earth science, and life science. They begin inside the Super Secret Science Station where a radar screen displays signals sent by the Science Scouts: Bobbie, Buddy, and Einstone. Students click on a signal to enter a learning environment and begin a science challenge activity. Each of the five sections (Day and Night, the Mystery Cave, Animal Tracks, What Did You See?, and Physics Fun) contains a series of progressively difficult activities. In Day and Night, students rotate a model of Earth to see how sunlight and rotation interact to make different times of day and night for specific places on the globe. Physics Fun contains simulated motion experiments in which students solve challenges that involve balls of different weights and adjustable straight and curved ramps. Students learn

System Requirements:
Windows: Windows 3.1 or Windows 95; 486 Pentium or better (33 mHz or faster recommended); 8MB RAM, 5MB free hard drive space required; 640x480 256-color display; 2x CD-ROM drive; sound card

Macintosh: System 7.0.1 or higher; 68030 (25 mHz or faster recommended) or Power PC; 8MB RAM erPC); 640x480 256-color display; 2x CD-ROM drive

about animals and seasons in What Did You See?, a memory game in which they strive to recall animals' locations in nature scenes. An additional game, Animal Tracks, shows students how to identify an animal's footprints by studying the number of toes, shape, pattern, and size of the foot. In the fifth game, the Mystery Cave, students use deductive reasoning to identify an unknown object by using tools that gather data about the smell, texture, color, shape, and weight of the object. As students solve the science challenges, they are rewarded with printable treasures to color, such as animal masks, puzzles, and games. The CD-ROM also contains options that allow parents to customize the program for their children. Winner, Software Magic Award, 1998. Silver Apple Award, 1998. (Author/LCT) ENC-012222

Star Wars Droidworks

Grades 5-12
1998
Author: Lucas Learning Ltd.
Publisher: San Rafael, CA: Lucas Learning Ltd.

Ordering Information:
Lucas Learning Company Store
PO Box 14797
Fremont, CA 94539
Telephone: (925) 275-1190
Fax: (303) 574-9442
Toll-free: (888) 887-7909
http://www.lucaslearning.com/

$39.95 per CD-ROM package

System Requirements:
Windows: Pentium with 133 mHz; 16MB RAM (32MB recommended); 34MB hard disk space; Windows 95 or Windows 98; 4x CD-ROM drive; 16-bit sound card; color PCI graphics card

Macintosh: Power PC 604 with 120 mHz or Power PC 603e with 160 mHz; 32MB RAM; 32 MB hard disk space; System 7.5.5 or higher; 4x CD-ROM drive; video with color graphics and 13 inch monitor

Disguised as a Jawa, players become Master Droid Builders on the planet Tatooine. They can design and build their own droids from 87 different robotic parts. The completed droids can then be sent on 29 different missions in which the player makes observations and decisions based on information and clues in the game. When designing the droids for their mission, students have to consider the physical aspects of the mission. If a droid is supposed to go up a steep incline where traction is a problem, the player needs to assemble parts to accomplish that goal. The droid parts available include heads, bodies, arms, hands, legs or wheels, and batteries. Each type of part is adapted for a specific need; for example, some heads have good night vision, while others have acute hearing. Players can choose to mix and match different kinds of arms and hands. The weight of each part is given so that the player can design a droid that is within specific weight limits. Completed droids can be viewed in all directions, and adjustments can be made before they are sent on their mission. The droids' direction and speed can be controlled with arrow buttons. Students are called on to make judgments about energy expenditure, because the faster the droids go the more energy they consume. Players can also investigate scientific principles involving machines, light, energy, forces, and materials. Within each category students can find background information on the topic as well as related open-ended questions. Highlighted scientific terms can be clicked to get definitions. Characters from the Star Wars movies provide tutorials and help. Animated cut scenes and movie clips from Star Wars are found in the game. (Author/JSR) ENC-014019

STAR WARS
STAR WARS
STAR WARS

My Amazing Human Body

Grades 1-5
1997
Author: senior editor, Mary Clare Mitchell; software team, Rohan du Heaume, Peter Forrest, Peter Rufthead

Ordering Information:
DK Publishing, Inc.
7800 Southland Boulevard, Suite 200
Orlando, FL 32809
Fax: (800) 260-7658
Toll-free: (800) 986-9921
http://www.dk.com/

$24.95 per CD-ROM

System Requirements:
Windows: 486DX-66mHz or higher; 12MB RAM; 26MB hard disk space; 640x480 256-color display; 2x CD-ROM drive or faster; 8 bit sound card; Windows 95; loudspeakers or headphones; for online features, Internet access needed

Macintosh: 68LC040/33 mHz processor or higher; System 7.1.2 or later; 8MB RAM (12 MB for System 7.5.3+ and PowerPC); 6MB hard disk space; 640x480 256-color display; 2x CD-ROM drive or faster; loudspeakers or headphones; for online features, Internet access needed

Hosted by a 3-D skeleton named Seemore Skinless, this CD-ROM encourages students to learn about the body from the inside out. Children may choose from four types of activities: What Am I Made Of?; Take Me Apart; Build Me a Body; and Me and My Day. In the first section, the user may choose a section of Seemore's body to inspect in greater detail. Clicking on a part brings up a fully narrated information screen that provides descriptions, cross-section views, and facts about that part or organ. The part can also be measured, x-rayed, or spun to see a different view. Children can dismantle Seemore in the Take Me Apart section and then familiarize themselves with the location of the parts as they drag them back to the correct location and snap them into place. Build Me a Body is a quiz show with Seemore acting as the master of ceremonies. Nineteen body parts are displayed on a screen above Seemore's head, and when the brain teaser button is pushed, one of the 19 parts is chosen. Players must answer the question correctly to add that part to the construction of the body. Once all parts have been collected, they are assembled into a version of Seemore that can be dressed with a variety of clothing and accessories. In the final game, Me and My Day, children see how different activities, such as reading, playing basketball, and napping, affect the amount of food, drink, and rest they require during a day. They choose when and how much Seemore should eat, drink, and play based on information from gauges that register his tiredness, hunger, thirst, heart rate, and breathing. Their goal is to get Seemore through his day in a healthy way. Included are printable experiments and a built-in link to DK's Active Learning Club web site. Winner, Best of 1997, Children's Software Revue (January/February 1998). (Author/JSR) ENC-014050

MY AMAZING Human Body
Human Body
MY AMAZING HUMAN BODY

Ocean Expeditions: El Niño

Grades 6-12
1998
Author: developed by Planet Earth Science

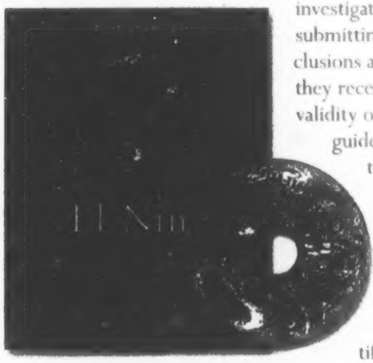
Ordering Information:
Tom Snyder Productions, Inc.
80 Coolidge Hill Rd
Watertown, MA 02172-2817
Fax: (617) 926-6222
Toll-free: (800) 342-0236
http://www.teachtsp.com/

$99.95 per CD-ROM (Macintosh)
Order # T-OEX
Note: Lab packs and site licensing available, call for details.

Funding: National Science Foundation; United States Department of Energy

System Requirements:
Macintosh: 68040 or higher; 8MB RAM; System 7.5 or later (System 7.5.3 for Power PC); 20MB hard disk space; 2x CD-ROM drive or faster; QuickTime 2.5 or later

The time is the early 21st century, and Dr. Enso, director of the Earth Monitoring Organization (EMO), has hired students as crew members of the Glomar fleet. This interactive, virtual research experiment is developed to teach students the fundamentals of the scientific method as they learn about Earth and its dynamic climate system. The simulated research mission concerns a predicted El Niño event that may have disastrous effects for life and economics around the world. Working in teams of four, students take on the roles of navigator, communications expert, data collector, and data analyst to determine if an El Niño weather pattern is forming. After developing a hypothesis, students test it by gathering and analyzing real NASA and NOAA data on sea surface temperature and pressure, wind and currents, and clouds and precipitation. According to the assigned role, each student is given a student activity booklet and then follows the scientific method to establish a hypothesis on the climate by learning about sea surface temperature and climate patterns. Students collect data from satellites and climate models of pressure, winds, currents, and clouds/precipitation. They then analyze data by learning about climate patterns and comparing present findings to historical data. These investigation processes are finished by submitting supporting evidence and conclusions about the climate, for which they receive a final report about the validity of their hypothesis. The teacher's guide provides directions for using the CD-ROM and indicates connections between the disc and the school curriculum. It also provides detailed scientific background, an assessment rubric with worksheet masters, and a step-by-step scientific inquiry framework. (Author/YK) ENC-013715



Exploring the Nardoo: An Imaginary Inland River Environment to Investigate, Maintain, and Improve

Grades 7-12
1997
Author: Interactive Multimedia Learning Laboratory faculty of Education, University of Wollongong with the NSW Department of Land and Water Conservation

Ordering Information:
IT'S ABOUT TIME Inc.
84 Business Park Drive,
Suite 307
Armonk, NY 10504
Fax: (914) 273-2227
Toll-free: (888) 698-8463
itstimefor@aol.com
http://ITS-ABOUT-TIME.com/

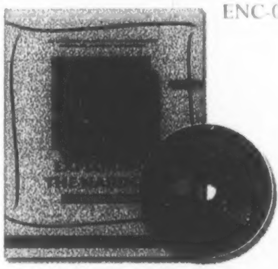
$149.95 per CD-ROM/teacher's guide set
Note: Lab packs and site licenses are available.

Standards: National Science Education Standards (December 1995)

System Requirements:
Windows: IBM or MPC2; 3MB RAM (8MB or more recommended); Windows 95; SVGA 256-color 640x480 display; 2x CD-ROM drive; SoundBlaster compatible card

Macintosh: 68020 or greater; 2.5 MB RAM above system requirements; System 7.1; 256-color 640x480 display; 2x CD-ROM drive; Sound manager 3.0

Using this interactive multimedia tool, students can perform virtual field work on a complex, changing river environment. Students assess the interactions between living organisms and the environment of the imaginary Nardoo River as it has evolved over four periods of time. In the four Nardoo River geographical regions (estuary, mangrove, open lake, and urban), students can make measurements, collect plant and animal life information, and view news footage on a variety of issues. They can also take electronic notes on their findings and put together a final multimedia report. The package helps students make connections between the human development on the river and changes in wildlife. They can explore how alterations in one location can have an impact on the environment far from the source of the change. Students have to make multidimensional assessments while making ecological decisions. They can see how their own actions affect the environment in simulations such as one in which they control the water usage (number of showers, toilet flushes, leaks, etc.) in a house. They are told if their usage is above the national average and are given options, such as aerators in faucets, to reduce consumption. The classroom guide contains a chapter with 12 lessons that take the students on a tour of the features on the CD-ROM. Once the students are trained to use the program, they employ those features in activity sets related to the biology, chemistry, and physical geology of the Nardoo River. Each activity contains a lesson plan with objectives, materials, and procedures. Some activities require the CD-ROM and others do not. Data sheets and worksheets are found throughout the classroom guide, as are assessable activities related to dam construction and management and chemical pollution. Finalist for Codie Awards, 1997. (Author/JSR) ENC-014195



The House Is Bugged!

Grades 2-5
1996
Author: Video Architects

Ordering Information:
Sunburst Communications, Inc.
101 Castleton Street
PO Box 100
Pleasantville, NY 10570
Telephone: (914) 747-3310
Fax: (914) 747-4109
Toll-free: (800) 321-7511
service@nysunburst.com
http://www.sunburstonline.com/

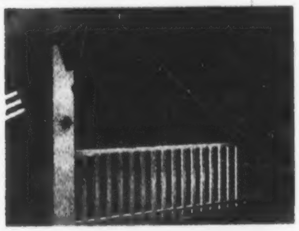
In this entomology game, students learn about bugs as they rid a virtual house of a variety of pests. The main screen of the CD shows the floor plan of a house with six rooms: a living room, kitchen, bedroom, bathroom, basement, and porch. Each room offers a choice of three-dimensional views. As students move around the room, a magnifying glass pops up to indicate the presence of a bug. After they capture it, students go to the laboratory where they use tools such as a microscope, a globe,

$89.95 per CD-ROM
Order # 8549HG
Standards: National Science Education Standards (December 1995)

System Requirements:
Windows: 486 with 66 mHz or faster; 16MB RAM; Windows 3.1 or higher; 4x CD-ROM drive; sound card; SVGA graphics with 256 colors

Macintosh: 68040 or faster; 8MB RAM; hard drive; System 7.1 or later; 640x480 256-color display; 4x CD-ROM drive

and a reference book, to identify their bug and learn about its habits and distinguishing characteristics. The microscope shows a close-up, live-action movie of the bug; the globe provides a narrative about the bug's natural habitat; and the reference book provides the scientific name of the bug and facts about its food preferences, reproduction, and classification. The lab also includes an Action Box that helps students decide what to do with their bug: Should they squash or spray it? Keep it as a pet or let it go? As students progress through the game, they earn points for every bug they find and identify. Additional points are awarded for choosing the safest, most ecologically sound method of getting rid of each insect. The teacher's guide provides an overview of the program, a bug location answer key, and eight classroom activities. Reproducible worksheets are also included. (Author/LCT) ENC-013696



Investigating Lake Iluka: Simulated Lake Environment Designed to Support the Teaching of Ecology

Grades 5-12
1997
Author: Grant Farr, John Orlandi

Ordering Information:
IT'S ABOUT TIME Inc.
84 Business Park Drive,
Suite 307
Armonk, NY 10504
Fax: (914) 273-2227
Toll-free: (888) 698-8463
itstimefor@aol.com
http://ITS-ABOUT-TIME.com/

$149.95 per CD-ROM/teacher's guide set

Standards: National Science Education Standards (December 1995)

System Requirements:
Windows: 8MB RAM; Windows 95; 2x CD-ROM drive; sound card; 256-color display

Macintosh: 68020 processor; 2.5MB RAM (4 recommended); System 7.1 or higher; 2x CD-ROM drive

In this CD's simulated lake environment, students can make physical, chemical, and biological measurements while investigating its ecosystems. Students may collect plant and animal life information, view news footage, and consult experts concerning issues in the four Lake Iluka ecosystems (estuary, mangrove, open lake, and urban). They can take electronic notes on their findings and put together a multimedia final report. Case studies of ecological scenarios are posed directly to the user through media reports of problems occurring in the lake. The three units outlined in the guide focus on change, systems, and patterns in nature. Some of the activities in the guide require the CD and others do not. The classroom guide contains both teacher and student resources for each theme and activity. The teacher's material includes notes on the purpose of the activity as well as suggestions for preparation, student guidance, and evaluation. The student pages contain introductions, materials, procedures, applications, and extensions. (Author/JSR) ENC-014194

CyberLearning Collection

Task Force Environmental Investigation Kit

Grade 10 and up
1997
Author: Ron S. Nolan, Susan A. Nolan

Ordering Information:
Digital Studios
209 Santa Clara Avenue
Aptos, CA 95003-4418
Telephone: (831) 688-3158
Fax: (831) 688-5738
Toll-free: (800) 499-3322
nolan@cyberlearn.com
http://www.cyberlearn.com/

$149.95 per kit
Note: Lab pack available.

System Requirements:
Windows: 386 or better; 8MB RAM; Windows 3.1 or Windows 95; 640x480 256-color display; sound card; hard drive; 2x CD-ROM drive

Macintosh: 8MB RAM; 640x480 256-color display; 2x CD-ROM drive

This kit, composed of a videotape, two CD-ROMs, a teacher's guide, and a web site, exposes students to the tensions of opposing opinions regarding the maintenance of salmon populations in Washington and Idaho. Students learn that, although human activities may directly or indirectly affect salmon populations, those activities offer jobs to thousands of people and make major contributions to the economy. As a result, many of the proposals for preserving salmon have been met with opposition because they would adversely affect businesses. To help students understand the complexity of the situation, the kit has been divided into four major units of study: natural history; hatcheries and harvest; the hydrosystem; and management plan. To begin the investigations, the class views the video to gain an overview of conflicting positions encountered in the program. The CD-ROMs contain video clips, tables, graphs, scientific reports, and personal perspectives. On the program's web site, students and teachers can post opinions, access new reports and editorials, and go to related links. They can also access worksheets and discussion questions related to the investigations in the kit. The teacher's guide offers setup and operating procedures for the students to work collaboratively on an inquiry-based learning project to develop their own management plan for the salmon. Worksheet masters are included. (Author/JSR) ENC-014254

Evaluation Criteria

Software

The following web sites provide criteria for evaluating children's educational software.

Children's Software Review
http://www2.childrenssoftware.com/childrenssoftware/

SuperKids Educational Software Review
http://www.superkids.com/aweb/pages/reviews/reviews.html

Schoolhouse Review
http://www.worldvillage.com/wv/school/html/scholrev.htm

California Instructional Technology Clearinghouse
http://clearinghouse.k12.ca.us/

Internet Resources

For criteria on evaluating web sites, see Kimberly Roempler's article on page 11.

Feedback and Subscription Form

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- ○ administrator
- ○ college/university faculty
- ○ librarian/media specialist
- ○ computer specialist
- ○ curriculum specialist
- ○ parent
- ○ student
- ○ other

My area is: (Check only one.)

- ○ elementary education
- ○ mathematics education
- ○ science education
- ○ math/science education
- ○ educational technology
- ○ computer science
- ○ library science
- ○ other

TEACHERS, circle those grades you teach:
ADMINISTRATORS, circle those grades for which you have responsibility:
TEACHER EDUCATORS, circle those grades for which you prepare teachers:

Pre-K K 1 2 3 4 5 6 7 8 9 10 11 12

I work in a (choose one): ○ public institution ○ private institution

Years of K-12 teaching experience: ______

How did you initially hear about ENC products/services? (Check all that apply.)

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- ○ World Wide Web Sites
- ○ ENC Online
- ○ Other ____________

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- ○ Conference Exhibit
- ○ ENC Demo Site Session
- ○ Training Session
- ○ Television Advertisement
- ○ Other ____________

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- ○ Technical staff
- ○ ENC staff
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- ○ It was mailed directly to me by ENC.
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- ○ I received it from a district administrator.
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- ○ I received it from another teacher.
- ○ I picked it up at a conference.
- ○ I received it at a professional development meeting.
- ○ Other ____________________

What suggestions do you have for improving this publication?

What type of computer do you use most often? (Check only one.)

○ Macintosh ○ PC ○ Other ____________ ○ I do not use a computer

How much memory capacity (mega bytes) does your computer have? (Check only one.)

○ *16MB* ○ *24MB* ○ *32MB* ○ *64MB+* ○ Do not know

How do you generally access the Internet?

○ I do not have Internet access
○ modem - 14.4 kbps or slower
○ modem - 28.8 kbps
○ modem - 33.6 kbps
○ modem - 56 kbps or faster
○ cable modem
○ direct connection (ie, LAN)
○ I do not know

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- ○ **parent**
- ○ **student**
- ○ **other**
- ○ **librarian/media specialist**
- ○ **computer specialist**
- ○ **college/university faculty**
- ○ **curriculum specialist**

My area is (Check only one):

- ○ **elementary education**
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- ○ **educational technology**
- ○ **computer science**
- ○ **math/science education**
- ○ **mathematics education**
- ○ **science education**
- ○ **other**

TEACHERS, circle those grades you teach: Pre-K K 1 2 3 4 5 6 7 8 9 10 11 12
ADMINISTRATORS, circle those grades for which you have responsibility:
TEACHER EDUCATORS, circle those grades for which you prepare teachers:

I work in a (choose one): ○ public institution ○ private institution Years of K–12 teaching experience: ______

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○ teacher
○ administrator
○ parent
○ student
○ other
○ librarian/media specialist
○ computer specialist
○ college/university faculty
○ curriculum specialist

My area is (Check only one):

○ elementary education
○ library science
○ educational technology
○ computer science
○ math/science education
○ mathematics education
○ science education
○ other

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